WAVETEK

INSTRUCTION MANUAL

MODEL 3007
SIGNAL GENERATOR/
DEVIATION METER

WAVETEK

INSTRUCTION MANUAL

MODEL 3007
SIGNAL GENERATOR/
DEVIATION METER

This document contains information proprietary to
Wavetek. The information in this document
is not to be used or duplicated in any manner without
the prior approval, in writing, of Wavetek.

Wavetek
Communications Division
5808 Churchman Bypass
Indianapolis, IN 46203-6109
(800)245-6356
(317)788-5965
Fax: (317)782-4607

REV.C
Manual Part No.
6510-00-0076

WARRANTY

Wavetek warrants that all Products manufactured or procured by Wavetek conform to Wavetek's published specifications and are free from defects in materials and workmanship for a period of one (1) year from the date of delivery to the original Buyer, when used under normal operating conditions and within the service conditions for which they were designed. This warranty is not transferrable and does not apply to used or demonstration products.

The obligation of Wavetek arising from a Warranty claim shall be limited to repairing, or at its option, replacing without charge, any assembly or component (except batteries) which in Wavetek's sole opinion proves to be defective within the scope of the Warranty. In the event Wavetek is not able to modify, repair or replace nonconforming defective parts or components to a condition as warranted within a reasonable time after receipt thereof, Buyers shall receive credit in the amount of the original invoiced price of the product.

Wavetek must be notified in writing of the defect or nonconformity within the Warranty period and the affected Product returned to Wavetek's factory, designated Service Provider, or Authorized Service Center within thirty (30) days after discovery of such defect or nonconformity. Buyer shall prepay shipping charges and insurance for Products returned to Wavetek or its designated Service Provider for warranty service. Wavetek or its designated Service Provider shall pay costs for return of Products to Buyer.

Wavetek shall have no responsibility for any defect or damage caused by improper storage, improper installation, unauthorized modification, misuse, neglect, inadequate maintenance, accident or for any Product which has been repaired or altered by anyone other than Wavetek or its authorized representative or not in accordance with instructions furnished by Wavetek.

The Warranty described above is Buyer's sole and exclusive remedy and no other warranty, whether written or oral, expressed or implied by statute or course of dealing shall apply. Wavetek specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. No statement, representation, agreement, or understanding, oral or written, made by an agent, distributor, or employee of Wavetek, which is not contained in the foregoing Warranty will be binding upon Wavetek, unless made in writing and executed by an authorized representative of Wavetek. Under no circumstances shall Wavetek be liable for any direct, indirect, special, incidental, or consequential damages, expenses, or losses, including loss of profits, based on contract, tort, or any other legal theory.

Extended Warranty Programs

Extended warranties and service contracts are available for new and currently owned equipment for an additional cost. Contact the Customer Service Department (800 851-1198) for details pertaining to extended warranties and service contracts.

Return Authorization Procedure

The customer MUST obtain a RETURN AUTHORIZATION NUMBER from the Customer Service Department (800 851-1198) prior to returning any equipment for warranty or non-warranty repair. Wavetek accepts no liability for any instrument or subassembly returned to the factory without this number. Any correspondence regarding returned instruments or subassemblies should be referenced to that number.

CONTENTS

SECTION 1 - GENERAL INFORMATION
1.1 INTRODUCTION
1.2 SPECIFICATIONS
1.3 ACCESSORIES

SECTION 2 - OPERATION
2.1 INTRODUCTION
2.2 MECHANICAL INSTALLATION
2.3 ELECTRICAL INSTALLATION
2.4 DESCRIPTION OF FRONT PANEL
2.5 DESCRIPTION OF REAR PANEL
2.6 INSTALLATION CHECKS
2.7 OPERATING PROCEDURE

SECTION 3 - THEORY OF OPERATION
3.1 INTRODUCTION
3.2 SIGNAL GENERATOR OVERVIEW
3.3 PHASE-LOCKED LOOPS
3.4 M172 - SWEEP DRIVE/DAC
3.5 M9W - SWEEP OSCILLATOR
3.6 M10W-17 - OUTPUT AMPLIFIER
3.7 M115 - DOWN CONVERTER
3.8 M35-2 - RF OUTPUT PROTECTION
3.9 B006 - METER BOARD
3.10 C316-7 - MODULATION BOARD
3.11 M30-9 - CRYSTAL REFERENCE
3.12 TUNE/DEVIATION MEASUREMENT SYSTEM
3.13 DPS2A - POWER SUPPLY
3.14 50130-01 - STEP ATTENUATOR

SECTION 4 - PERFORMANCE TESTS
4.1 INTRODUCTION
4.2 FREQUENCY RANGE AND RESOLUTION TESTS
4.3 FREQUENCY ACCURACY TEST
4.4 FREQUENCY STABILITY TEST
4.5 OUTPUT LEVEL ACCURACY TEST
4.6 HARMONIC TEST
4.7 NON-HARMONIC TEST
4.8 RESIDUAL AM TEST
4.9 RESIDUAL FM TEST
4.10 INTERNAL MODULATION FREQUENCY ACCURACY TEST
4.11 PERCENT AM ACCURACY TEST
4.12 AM BANDWIDTH TEST
4.13 AM DISTORTION TEST
4.14 FM DEVIATION ACCURACY TEST
4.15 FM BANDWIDTH TEST

CONTENTS (Continued)

4.16 FM DISTORTION TEST
4.17 IMPEDENCE TEST
4.18 RFI TEST
4.19 INPUT LEVEL TEST
4.20 TUNING NULL TEST
4.21 DEVIATION ACCURACY TEST
4.22 RF PROTECTION CHECK
**** PERFORMANCE TEST RECORD

SECTION 5 - MAINTENANCE
5.1 INTRODUCTION
5.2 SERVICE INFORMATION
5.3 CALIBRATION PROCEDURE
5.4 TROUBLESHOOTING

SECTION 6 - REPLACEABLE PARTS
6.1 INTRODUCTION
6.2 MANUFACTURERS CODE
*** PARTS LIST

SECTION 7 - SCHEMATICS
7.1 INTRODUCTION
7.2 SCHEMATIC NOTES
7.3 ABBREVIATION CODE
7.4 SCHEMATICS INDEX
*** SCHEMATICS

SECTION 8 - MANUAL CHANGES
8.1 INTRODUCTION
8.2 MANUAL CHANGES

1.1 INTRODUCTION

The Model 3007 Signal Generator/ Deviation Meter incorporates a complete 1 kHz to 520 MHz FM, AM, and CW Signal Generator with an FM Deviation Meter in one convenient instrument.

1.1.1 FREQUENCY CHARACTERISTICS

The frequency of the unit is set via 6 front-panel Lever/Indicator switches which yield a resolution of 1 kHz. In addition, remote frequency programmability is standard. Series 3900 programmers are available to facilitate semi-automatic or GPIB programming of frequency.

The accuracy of the instrument is based on a crystal-controlled oscillator that serves as a stable frequency reference to enable the instrument to provide high stability signals to an accuracy of 0.001% over its specified frequency range. This accuracy includes possible errors due to short term drift, long term drift, incidental FM, and variations due to line voltage changes and temperature changes. With the FREQUENCY VERNIER out of the CAL position, the frequency is accurate to 0.001% $\pm$10 kHz.

1.1.2 MODULATION

The Model 3007 also features both internal and external amplitude and frequency modulation capabilities. Internal modulation frequencies of 400 Hz and 1 kHz are provided. In the FM mode of operation, peak deviations up to 500 kHz are attainable. In the AM mode, amplitude modulation to 90% is attainable.

With the MODULATION MODE switch in the AM position and the MODULATION FREQUENCY switch in the DC position, the output amplitude can be varied by the MODULATION FM/AM control. This provides a reference attenuator for variation of a signal level around a specific point of interest. This operation can also enable the user to obtain greater than 20 milliwatts of RF output power over portions of the band. With the MODULATION MODE switch set to one of the FM positions, the frequency can be continuously varied with the MODULATION FM/AM control over a 50 or 500 kHz range.

1.1.3 OUTPUT LEVEL FEATURES

The output power is indicated on a front-panel METER calibrated in both dBm and VRMS. A fifteen-position, 10 dB/step Attenuator, used in conjunction with an 11 dB VERNIER control, provides the user with an output range of +13 dBm to -137 dBm.

The calibrated output of the instrument is leveled to $\pm$0.75 dB across the complete frequency range.

An RF circuit breaker provides the output circuitry with reverse-power protection.

1.1.4 DEVIATION METER

The Deviation Meter section of the Model 3007 permits quick and accurate measurements of FM deviation. A green LED indicates the presence of a suitable input signal for FM deviation measurement. Meter nulling is not critical. Any null less than "1" on the scale is sufficient. Deviation ranges of 0 to 50 kHz and 0 to 500 kHz are provided. Each has a + and - function for checking deviation symmetry.

1.2 SPECIFICATIONS

1.2.1 FREQUENCY

RANGE	1 kHz to 520 MHz selectable in 1 kHz steps
READOUT	6 digit Lever/Indicator switches
RESOLUTION	1 kHz
ACCURACY	±0.001% after 15 min. (Typically ±0.0002% after 2 hours within 3 months of calibration.)(±0.001% ±10 kHz when FREQUENCY VERNIER is not in CAL.)
STABILITY	All modes (CW, AM and FM) < 0.2 ppm/hour (500 Hz/10 min when FREQUENCY VERNIER is not in CAL.)
PROGRAMMABILITY	Frequency is programmable via rear-panel input connector using BCD-coded TTL voltages or BCD-coded contact closures (negative true logic).

1.2.2 RF OUTPUT

POWER LEVEL RANGE	+13 dBm to -137 dBm (1 VRMS to .03 µVRMS)
LEVEL CONTROL	Continuously adjustable in 10 dB steps with an 11 dB VERNIER. Output level is indicated on front-panel METER calibrated in VRMS and dBm.
TOTAL LEVEL ACCURACY	+13 to -7 dBm ±1.25 dB (Typically ±0.75 dB) -7 to -77 dBm ±1.95 dB (Typically ±1.25 dB) < -77 dBm ±2.75 dB (Typically ±1.5 dB)
ACCURACY BREAKDOWN	Flatness (+13 to -7 dBm) ±0.75 dB (Typically ±0.5 dB.) Output METER ±0.5 dB Step Attenuator ±0.5 dB to 70 dB (±0.2 dB calibration error). ±1.0 dB to 130 dB (±0.5 dB calibration error).
IMPEDANCE	50 ohms
SWR	< 1.3 at RF output levels below 0.1 V
OUTPUT CONNECTOR	Type N
RFI LEAKAGE	< 1 µV is induced in a two-turn, one-inch diameter loop which is held one inch away from any surface. Loop feeds a 50 ohm receiver.

1.2.3 RF OUTPUT PROTECTION

TYPE	Resettable RF circuit breaker
FREQUENCY RANGE	1 kHz to 520 MHz
RF TRIP VOLTAGE	5 VRMS nominal
MAXIMUM REVERSE POWER	50 W (50 VRMS)
TRIP TIME	< 2 msec

1.2.4 SPECTRAL PURITY

HARMONIC OUTPUT

< -30 dBc 1 kHz to 1 MHz
< -26 dBc 1 MHz to 10 MHz
< -30 dBc 10 MHz to 520 MHz

SUB-HARMONICS: None detectable

NON HARMONICS

Fundamental (MHz)	Non-Harmonic (MHz)	Non-Harmonic Level (dBc)
below 3	below 3	< -60
3 to 250	3 to 250	< -65
3 to 350	3 to 350	< -55
3 to 520	3 to 1000	< -35

RESIDUAL AM: < -65 dBc in a 50 Hz to 15 kHz post detection bandwidth.

RESIDUAL FM: < 100 Hz in 300 Hz to 3 kHz post detection bandwidth (Typically < 50 Hz).
< 200 Hz in 50 Hz to 15 kHz post detection bandwidth (Typically < 100 Hz).

1.2.5 AMPLITUDE MODULATION

NOTE: These specifications apply for a carrier level ≤ +3 dBm. AM is possible above +3 dBm if peak output does not exceed +13 dBm.

FREQUENCY

INTERNAL: 400 Hz and 1 kHz ±5%

EXTERNAL: DC to 20 kHz, (3 dB bandwidth), input level required = 10 Vpp into 600 ohms to provide calibrated % modulation control.

RANGE: 0 to 90%

MODULATION CONTROL: Calibrated from 0 to 90%

ACCURACY	±8% at a frequency of 1 kHz
DISTORTION	< 3% to 70% AM (Typically 1.5% to 30% AM) < 5% to 90% AM (At a frequency of 1 kHz)

1.2.6 FREQUENCY MODULATION

FREQUENCY	
INTERNAL	400 Hz and 1 kHz, 5%
EXTERNAL	50 Hz to 100 kHz, (3 dB bandwidth), input level required = 10 Vpp into 600 ohms to provide calibrated deviation control. (DC to 100 kHz when FREQUENCY VERNIER is not in CAL)
DEVIATION RANGE	Two bands, 0 to 50 kHz, and 0 to 500 kHz
DEVIATION CONTROL	Calibrated from 0 to 50 kHz, x1 and x10
ACCURACY	±2.5 kHz on x1 range; ±25 kHz on x10 range
DISTORTION	< 4% 3 kHz to 200 kHz deviation (At a frequency of 1 kHz)

1.2.7 FM DEVIATION METER

FREQUENCY RANGE	30 MHz to 500 MHz
INPUT LEVEL RANGE	10 mVRMS to 5 VRMS
IMPEDANCE	50 ohms
DEVIATION RANGE	0 to ±50 kHz 0 to ±500 kHz
FREQUENCY RESPONSE	100 Hz to 8 kHz
DEVIATION ACCURACY	4% F.S. at 1 kHz 6% F.S. from 100 Hz to 8 kHz

1.2.8 ENVIRONMENTAL SPECIFICATIONS

Meets MIL-T-28800B for Class 5 equipment

1.2.9 GENERAL

POWER	115/230 VAC ±10%, 50 to 400 Hz, 40 VA
DIMENSIONS	30.3 cm wide x 13.4 cm high x 34.9 cm long (12" x 5¼" x 13¾").
WEIGHT	13 kg (28.6 lb)

1.3 ACCESSORIES

Furnished with instrument	Instruction Manual
	Rear-panel programming plug and terminals
Additional Accessories	Rack Mount Kit, K108
	Programmers for single pushbutton or GPIB control of selected frequencies, Series 3900.
	Module Service Kit, K004

SECTION 2

OPERATION

2.1 INTRODUCTION

This section provides complete installation and operating instructions for the Wavetek Model 3007. The instructions include information on mechanical installation, electrical installation, front-and-rear-panel features, installation checks and operating procedures.

2.2 MECHANICAL INSTALLATION

2.2.1 INITIAL INSPECTION

After unpacking the instrument, visually inspect external parts for damage to knobs, connectors, surface areas, etc. The shipping container and packing material should be saved in case it is necessary to reship the unit.

2.2.2 DAMAGE CLAIMS

If the instrument received has been damaged in transit, notify the carrier and either the nearest Wavetek area representative or the factory in Indiana.

Retain the shipping carton and packing material for the carrier's inspection.

The local representative or the factory will immediately arrange for either replacement or repair of your instrument without waiting for damage claim settlements.

2.2.3 RACK MOUNTING (K108)

CONTENTS (See Figure 2-1).

ITEM	QTY	PART NO.
A (Insert)	2 ea	1410-00-4650
B (Side)	2 ea	1410-00-5260
C (Screw)	8 ea	2810-17-8108
D (Screw)	4 ea	2810-17-8110

PROCEDURE

Remove the screws from one side panel. Mount items A and B against side panel of the instrument and secure with screws provided. Repeat for other side of unit. If rack mount kit is removed from unit, use screws originally installed in side panels to avoid possible internal damage.

2.3 ELECTRICAL INSTALLATION

The instrument can operate from either 115 VAC or 230 VAC supply mains. The rear-panel AC LINE switch selects which of these operating voltages is being used, and adjusts the Power Supply accordingly. The Power Supply is designed to operate over an AC supply frequency range of 50 to 400 Hz.

Instruments are shipped from the factory set up for 115 VAC operation unless otherwise specified.

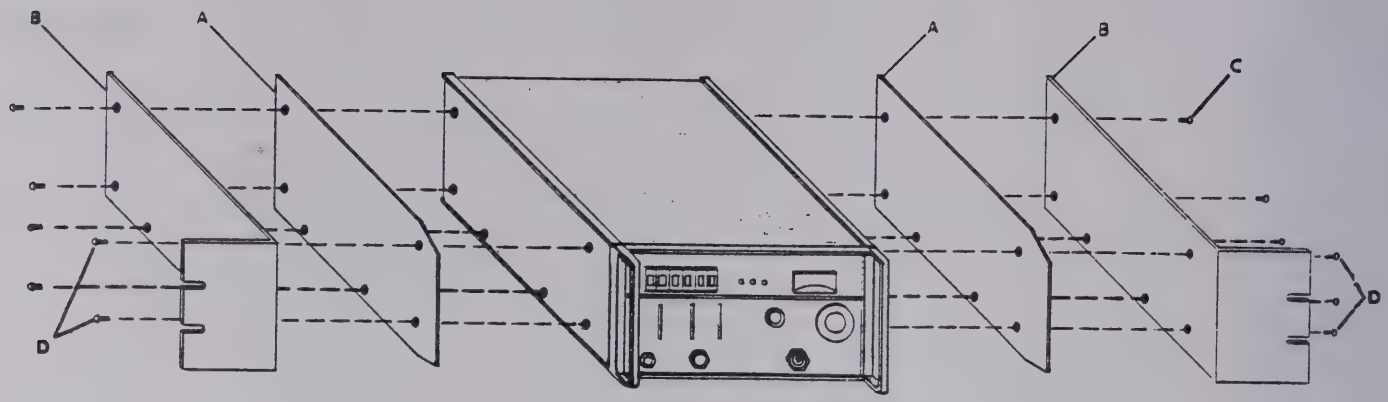


Figure 2-1. K108 Rack Mount

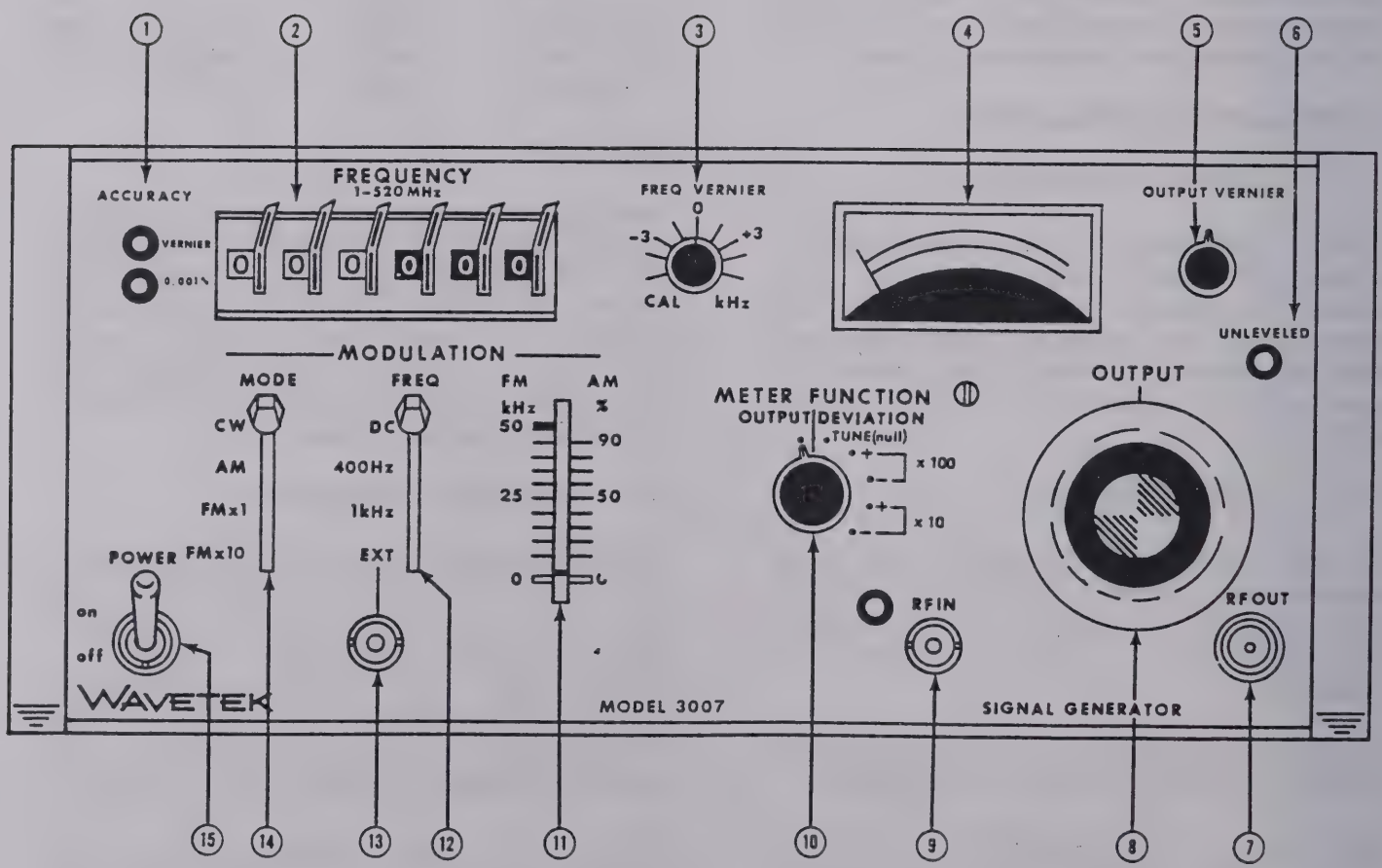


Figure 2-2. Front Panel

NOTE

Before operating the instrument, check that the rear-panel AC LINE FUSE is the correct value for the supply voltage (see Section 2.5).

2.4 DESCRIPTION OF FRONT PANEL

Refer to Figure 2-2.

(1) ACCURACY lamps indicate the frequency accuracy of the instrument.

"VERNIER" indicates ±0.001% +10 kHz
"0.001%" indicates ±0.001%

Typically, the lamp will flash for a few seconds after the instrument is turned on. Normally, a steady light indicates that the instrument is phase locked and the frequency accuracy indicated is valid. A continuously flashing light indicates that one or more of the phase-locked loops is open.

(2) Level/Indicator switches select and indicate output frequency.

(3) FREQ VERNIER shifts output frequency over a 10 kHz range (-5 kHz to +5 kHz).

With the FREQ VERNIER in CAL, the instrument accuracy is ±0.001%. When the FREQ VERNIER is not in CAL, the instrument accuracy is ±0.001% + 10 kHz.

(4) METER indicates RF output level over a 10 dB range in VRMS and dBm. It also indicates FM deviation on two ranges, 0-50 kHz and 0-500 kHz.

(5) OUTPUT VERNIER controls the RF output level over an 11 dB range.

(6) UNLEVELED lamp lights when the METER output level reading is not valid.

(7) RF OUT connector (type N) provides the RF output signal from the instrument.

(8) OUTPUT Step Attenuator controls the RF output level over a 140 dB range from +10 to -130 dBm in 10 dB steps. The Attenuator dial indicates both dBm and VRMS.

(9) RF IN connector (BNC) accepts the external signal for deviation measurement. The green LED indicates the presence of a usable external signal.

(10) METER FUNCTION switch allows METER to indicate RF output, tuning null, or FM deviation.

(11) MODULATION FM/AM slider determines the depth of amplitude modulation or peak frequency deviation depending on the setting of the MODULATION MODE switch (with the MODE switch in CW, the FM/AM slider has no function).

(12) MODULATION FREQ switch selects the frequency of the signal used to modulate the RF output. The instrument has internal 400 Hz and 1 kHz sources, and a DC source for manual amplitude or frequency control. There is also provision for an external modulating signal.

(13) EXT MODULATION connector (BNC) accepts external modulating signals as follows:

AM	DC to 20 kHz
FM (FREQ VERNIER in CAL)	50 Hz/100 kHz
FM (FREQ VERNIER not in CAL)	DC/100 kHz

A 10 Vpp signal into 600 ohms is required for MODULATION FM/AM slider calibration to be correct. A smaller input voltage will result in proportional calibration of the FM/AM slider, thus, a 1 Vpp signal into 600 ohms will result in a full scale calibration of 10% AM, 5 kHz peak deviation in FMx1, or 50 kHz peak deviation in FMx10.

(14) MODULATION MODE switch selects CW, AM, FMx1, or FMx10 operation.

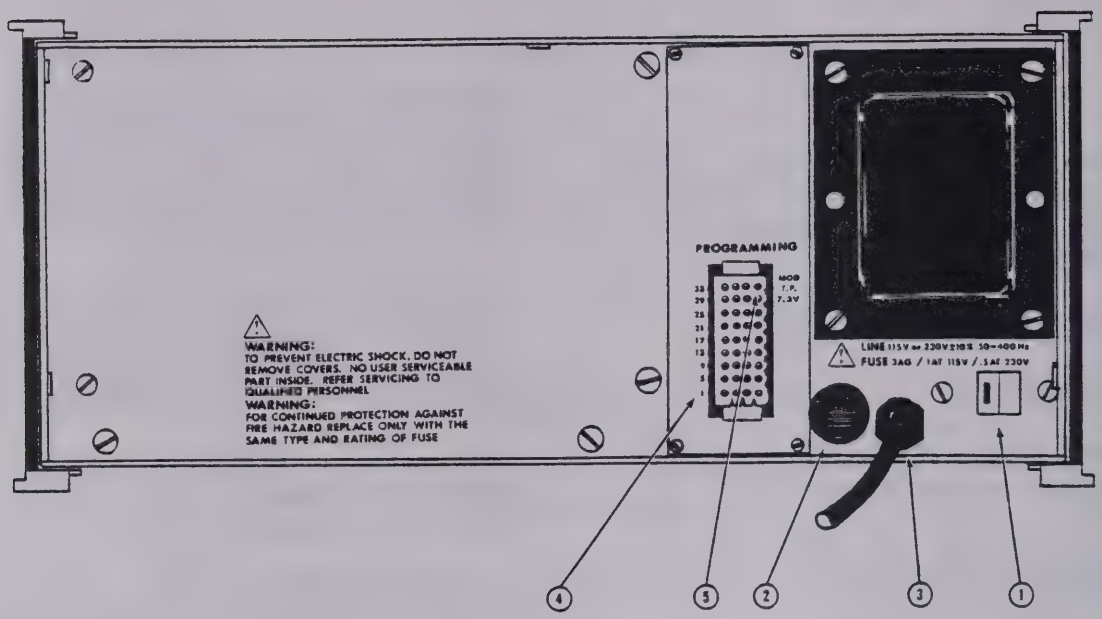

PROGRAMMING
WARNING:
TO PREVENT ELECTRIC SHOCK, DO NOT REMOVE COVERS. NO USER SERVICEABLE PART INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL
WARNING:
FOR CONTINUED PROTECTION AGAINST FIRE HAZARD REPLACE ONLY WITH THE SAME TYPE AND RATING OF FUSE
4
5
2
3
1

Figure 2-3. Rear Panel

NOTE: MUST BE HIGH-FREQUENCY OSCILLOSCOPE (GREATER THAN 10 MHz)

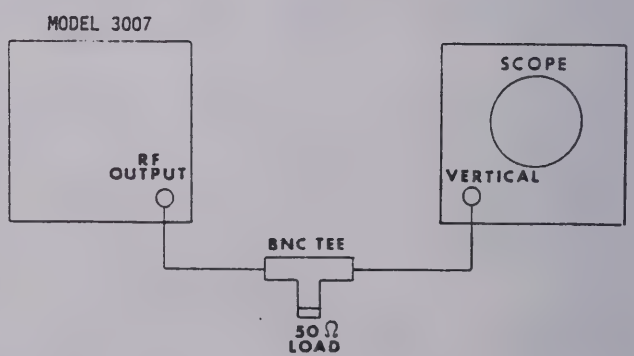


Figure 2-4. Test Setup

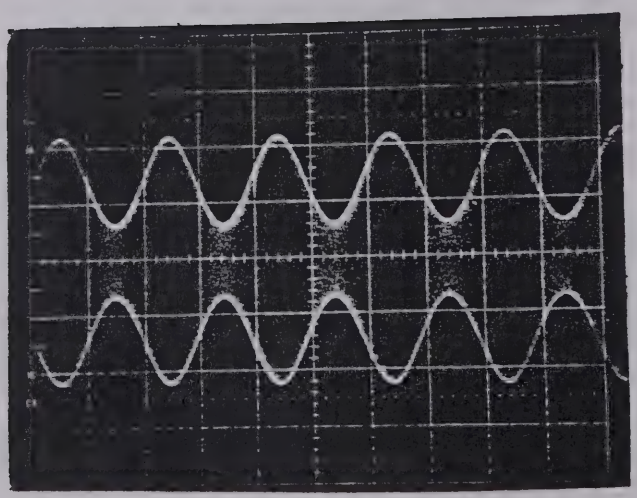


Figure 2-5. Amplitude Modulation

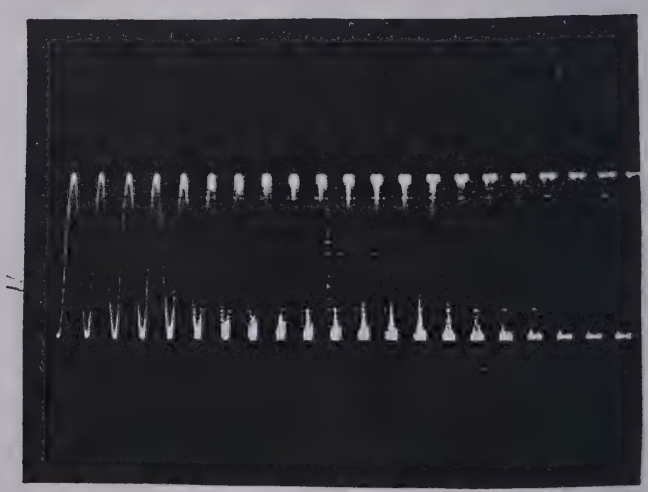


Figure 2-6. Frequency Modulation

(15) POWER switch provides AC power to Power Supply.

2.5 DESCRIPTION OF REAR PANEL

Refer to Figure 2-3.

(1) AC LINE switch enables unit to operate from either 115 VAC or 230 VAC supply mains.

(2) AC LINE FUSE (time-delay); 1.0 amp for 115 VAC operation; 0.5 amp for 230 VAC operation.

(3) AC LINE cord provides connection to AC mains via 3 prong plug.

(4) PROGRAMMING jack provides connection for remote programming of frequency.

(5) MOD TP provides convenient connection for monitoring amplitude and/or frequency of internal modulating signal.

2.6 INSTALLATION CHECKS

The following procedure is used to determine that the instrument is operating properly. Performance testing and calibration procedures for the instrument are contained in other sections of this manual. If it is determined that the unit is not operating properly, refer to these sections.

2.6.1 TURN-ON

Verify that the power transformer primary is matched to the available line voltage, and that the proper fuse is installed (see Section 2.5). Turn the POWER switch to ON. One of the front-panel ACCURACY lamps will indicate operation. No warmup is needed for the following checks.

2.6.2 INITIAL CONTROL ADJUSTMENT

Set the instrument front-panel control as follows:

FREQUENCY selector	0.10.0000
FREQ VERNIER	CAL
MODULATION MODE	CW
MODULATION FREQ	1 kHz
MODULATION FM/AM	0
METER FUNCTION	OUTPUT
OUTPUT Step	0 dBm
OUTPUT VERNIER	full cw

2.6.3 RF OUTPUT CHECK

Connect the equipment as shown in Figure 2-4. The 10 MHz signal should be ~ 0.9 Vpp. (A high-frequency oscilloscope must be used for these checks.)

2.6.4 AM CHECK

Set the MODULATION MODE switch to AM and adjust the MODULATION FM/AM slider to its 50% AM point. Verify that the AM envelope displayed on the oscilloscope has a peak-to-valley voltage of ~ 0.45 V and period of 1 msec (see Figure 2-5).

Set the MODULATION FREQ switch to 400. The peak-to-valley voltage should still be ~ 0.45 V, and the period should now be 2.5 msec.

Move the MODULATION FM/AM slider both ways, verifying that the AM envelope on the scope display rises and falls accordingly.

NOTE

The UNLEVELED lamp may come on during this test.

2.6.5 FM CHECK

Set the MODULATION MODE switch to FMx1. Move the MODULATION FM/AM slider both ways, verifying that an FM display appears on the oscilloscope (see Figure 2-6).

Set the MODULATION MODE switch to FMx10 and repeat.

Set the MODULATION FREQ switch to DC and verify that moving the MODULATION FM/AM slider causes a corresponding change in frequency.

2.6.6 ATTENUATION CHECK

Set the MODULATION MODE switch to CW. Verify that both the OUTPUT Step and VERNIER controls vary the amplitude of the signal displayed on the oscilloscope, and that the OUTPUT VERNIER varies the METER reading of RF output level.

2.6.7 FREQ VERNIER CHECK

Switch the FREQ VERNIER out of its CAL position. The .001% lamp should go out and the VERNIER lamp should light. Moving the VERNIER from -5 kHz to +5 kHz should show a slight change in frequency on oscilloscope.

2.6.8 TUNE FUNCTION

In order to verify the operation of the instrument's tune and deviation measurement functions, an external signal generator (Wavetek Model 3001 or equivalent) is required. Set the instrument front-panel controls as follows:

METER FUNCTION	TUNE
FREQ VERNIER	CAL
MODULATION MODE	CW
ALL OTHERS	N/A

Set the external signal generator to put out a 403.500 MHz signal at 0 dBm. Connect the RF output of the external signal generator to the RF IN connector on the instrument front panel. The green RF IN LED should light when this connection is made.

Set the instrument front-panel FREQUENCY selector for 404.000 MHz. The instrument front-panel METER should read "5" or full scale.

Now set the instrument front-panel FREQUENCY selector for 403.900 MHz. The METER should read "4".

Repeat this procedure for the frequencies listed below.

EXTERNAL FREQUENCY.....403.500 MHz

INSTRUMENT FRONT-PANEL FREQUENCY (MHz)	INSTRUMENT METER READING
403.800	3
403.700	2
403.600	1
403.500	0
403.400	1
403.300	2
403.200	3
403.100	4
403.000	5

For all instrument front-panel frequencies less than 403.000 MHz, and greater than 404.000 MHz, the METER should read "5".

2.6.9 DEVIATION MEASUREMENT FUNCTION

Keeping the set-up as described above, set the instrument front-panel switches to 403.500 MHz. The METER should now read 0. Set the external signal generator to put out an FM signal of about 25 kHz peak deviation. Set the METER FUNCTION switch to -x10. The METER should read about 25 kHz (Half scale). Set the METER FUNCTION switch to +x10. The METER should still read about 25 kHz.

Now set the signal generator to put out an FM signal of about 100 kHz. Set the instrument METER FUNCTION switch to -x100. The METER should read about 100 kHz.

Set the METER FUNCTION switch to +x100. The METER should still read about 100 kHz.

2.7 OPERATING PROCEDURE

No preparation for operation is required beyond completion of the initial installation checks contained in Section 2.6. To ensure that the instrument will perform as stated in the specifications, the instrument should have a two-hour warmup before using.

2.7.1 TURN-ON

Turn the POWER switch to ON. One of the front-panel ACCURACY lamps will light, indicating an operating condition. A flashing light indicates an unlocked condition. This should cease in a matter of seconds.

If the unit is not going to be used to the extreme limits of its specifications, it can be used immediately.

2.7.2 FREQUENCY SELECTION

Select the frequency desired with the six Lever/Indicator switches on the front panel. A frequency between 1 kHz and 520 MHz can be selected with 1 kHz resolution.

2.7.3 OUTPUT LEVEL SELECTION

Set the OUTPUT Attenuator and VERNIER to the desired level. The output is continuously adjustable over a +13 to -137 dBm range. The RF output equals the level shown on the Attenuator algebraically added to the METER indication.

2.7.4 AMPLITUDE MODULATION-INTERNAL

Set the MODULATION MODE switch to AM and the MODULATION FREQ switch to 400 or 1000 Hz. Adjust the MODULATION FM/AM slider to indicate the desired modulation depth.

2.7.5 AMPLITUDE MODULATION-EXTERNAL

CAUTION

Input voltages greater than ±10 VDC or 10 VRMS should not be applied to the EXT MODULATION connector or damage may occur to the instrument.

Set the MODULATION MODE switch to AM and the MODULATION FREQ switch to EXT. Apply a 10 Vpp signal into 600 ohms to the EXT MODULATION connector. This calibrates the MODULATION FM/AM slide control. The upper frequency limit of this input is 20 kHz.

NOTE

When AM modulating, care must be taken to not exceed the +13 dBm maximum level or excessive distortion and an unleveled condition can exist. In some cases, a high % AM may cause the UNLEVELED light to come on when the VERNIER is at minimum. This is caused by "bottoming" of the PIN diode leveler which, in turn, can cause an increase in distortion. If this is the case, add 10 dB of fixed attenuation and turn the VERNIER toward maximum. The UNLEVELED light should then go out.

2.7.6 FREQUENCY MODULATION-INTERNAL

Set the modulation mode switch to FMx1 or FMx10 and adjust the MODULATION FREQ switch to 400 or 1000 Hz. Adjust MODULATION FM/AM slider for the desired peak deviation.

2.7.7 FREQUENCY MODULATION-EXTERNAL

CAUTION

Input voltages greater than ±10 VDC or 10 VRMS should not be applied to the EXT MODULATION connector or damage may occur to the instrument.

Set the MODULATION MODE switch to FMx1 or FMx10 and the MODULATION FREQ switch to EXT. Apply a 10 Vpp signal into 600 ohms to the EXT MODULATION connector. This calibrates the MODULATION FM/AM slide control. For FM, the upper frequency limit is 500 kHz. The lower limit is 50 Hz with the FREQ VERNIER in CAL, or DC with the FREQ VERNIER not in CAL.

2.7.8 MODULATION FM/AM SLIDER-FM/DC

Set the MODULATION MODE switch to FMx1 or FMx10 and the MODULATION FREQ switch to DC. Using the MODULATION FM/AM slide control, the instrument output frequency can be increased up to 50 kHz in the x1 position and 500 kHz in the x10 position.

2.7.9 MODULATION FM/AM SLIDER-AM/DC

Set the MODULATION MODE switch to AM and the MODULATION FREQ switch to DC. Using the MODULATION FM/AM slide control, the output amplitude can be increased. This enables more than 20 mW of power to be obtained over portions of the band.

2.7.10 FREQ VERNIER

When the FREQ VERNIER is in CAL, output frequencies having an accuracy of ±0.001% may be selected by the Lever/Indicator switches with a resolution of 1 kHz. When the FREQ VERNIER is not in CAL, the selected output frequency can be shifted ±5 kHz with the FREQ VERNIER. The output frequency at the "0" kHz position of the FREQ VERNIER corresponds closely to the output frequency in CAL.

2.7.11 TUNE FUNCTION

In order to determine the frequency of an external CW signal, set the METER FUNCTION switch to TUNE, the MODE switch to CW, and the FREQ VERNIER to CAL. Connect the external signal to the RF IN connector (the green LED should light), and tune the FREQUENCY selector until the METER reads "0".

NOTE

The METER will "0" at two points 4 MHz apart. The higher FREQUENCY selector reading will equal the external signal.

2.7.12 DEVIATION MEASUREMENT FUNCTION

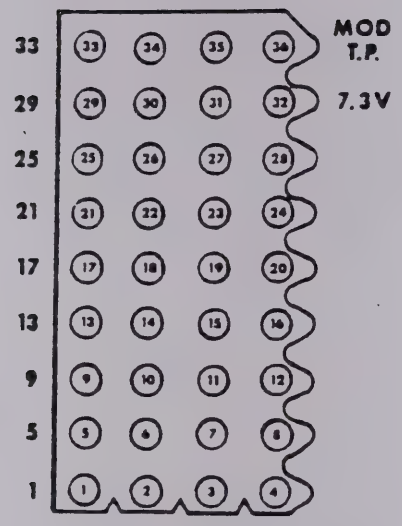
To determine the FM deviation of an external signal, first determine the carrier frequency using the TUNE function as in Section 2.7.11. Leaving the FREQUENCY selector at the "0" METER reading frequency, set the METER FUNCTION switch to the desired range and read the deviation indicated on the METER.

2.7.13 PROGRAMMING

Frequency is programmable via a rear-panel input connector using standard 8-4-2-1 BCD contact closure or TTL signals (refer to Figure 2-7). Logic "0" = open = ≥ 2.2V. Logic "1" = closed = ≤ 0.4 V. The rear-panel PROGRAMMING jack pins are in parallel with the front-panel FREQUENCY selector; thus, if rear-panel programming is to be implemented, the front-panel switches must indicate all zeroes.

Example - To program 132.450 MHz:

FREQ DIGIT	1	3	2	4	5	0
GROUND PINS	4	7,8	11	14	18,20	-



PIN	CONNECTION	
1	N.C.	
2	400	100's
3	200	
4	100	
5	80	
6	40	10's
7	20	
8	10	
9	8	
10	4	1's
11	2	
12	1	
13	.8	
14	.4	.1's
15	.2	
16	.1	
17	.08	
18	.04	.01's
19	.02	
20	.01	
21	.008	
22	.004	.001's
23	.002	
24	.001	
25	ground	
26 - 31	N.C.	
32	7.3V	
33 - 35	N.C.	
36	MOD. T.P.	

Figure 2-7. Pin Identification

3.1 INTRODUCTION

This section presents an overall view of the signal generator, followed by more detailed circuit descriptions where appropriate. Refer to the schematics in Section 7 of this manual, and to Figures 5-5 and 5-6 for additional information concerning circuit wiring and component/assembly location.

3.2 SIGNAL GENERATOR OVERVIEW

Refer to Figure 3-1.

The signal generator is essentially a 1 to 520 MHz voltage-controlled oscillator to which phase-locked loops and a crystal reference have been added for improved accuracy and resolution. A down-converter system provides frequencies below 1 MHz.

3.2.1 RF GENERATION

The RF output frequency is generated by two UHF oscillators (termed "wide" and "narrow") and a mixer. The outputs of the two oscillators are heterodyned in the mixer. The difference frequency is amplified and fed to an output amplifier.

The frequencies of these oscillators are controlled by DC voltages applied to their varactor diodes. The narrow oscillator yields a single frequency. The wide oscillator can be programmed over a range which extends from the frequency of the narrow oscillator to 520 MHz higher than the narrow oscillator frequency.

3.2.2 RF FREQUENCY CONTROL

The RF output frequency is determined by programming the frequency of the wide oscillator. The wide oscillator is ultimately controlled by the front-panel FREQUENCY selector, whose BCD output is converted to an analog voltage which programs the oscillator in 1 MHz steps. This analog signal can provide approximately 3 MHz accuracy.

3.2.3 RF AMPLIFICATION AND LEVELING

The RF signal is amplified by a multi-stage, wide-band amplifier. The flat output is maintained by a closed-loop leveling system around this amplifier.

The leveling system includes a monitor diode, an error amplifier, and a voltage-variable attenuator. The monitor detects the peak output of the amplifier. This detected level is

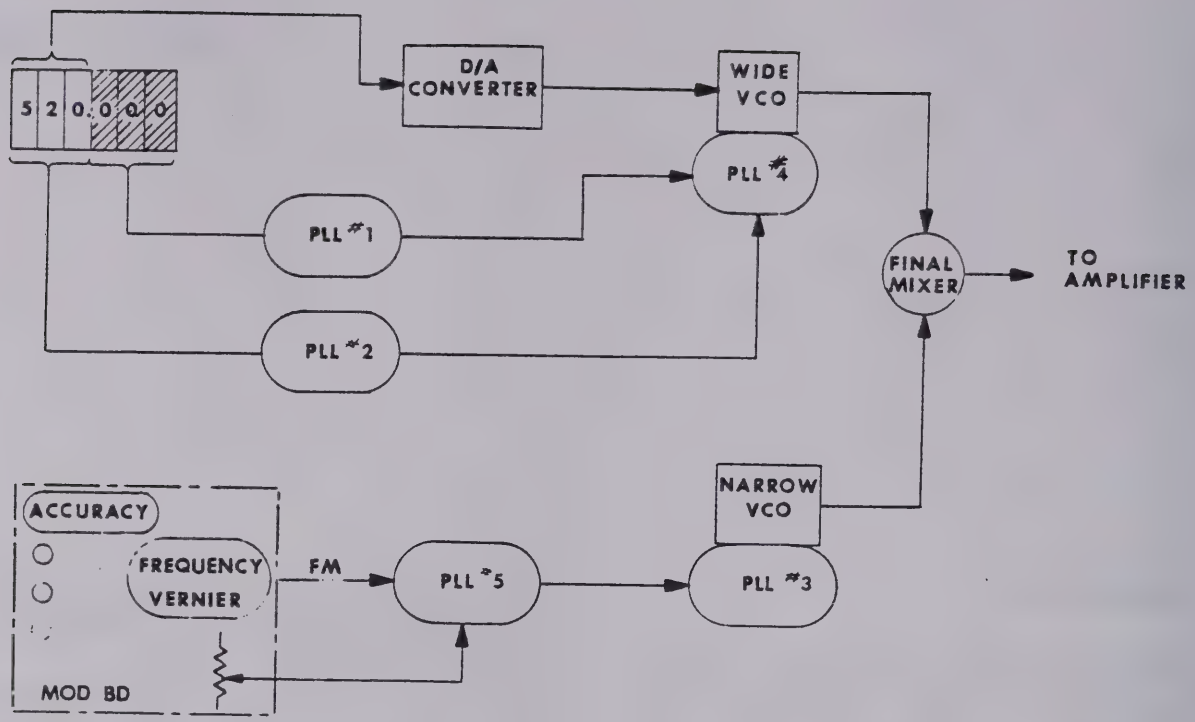


Figure 3-2. PLL Relationships

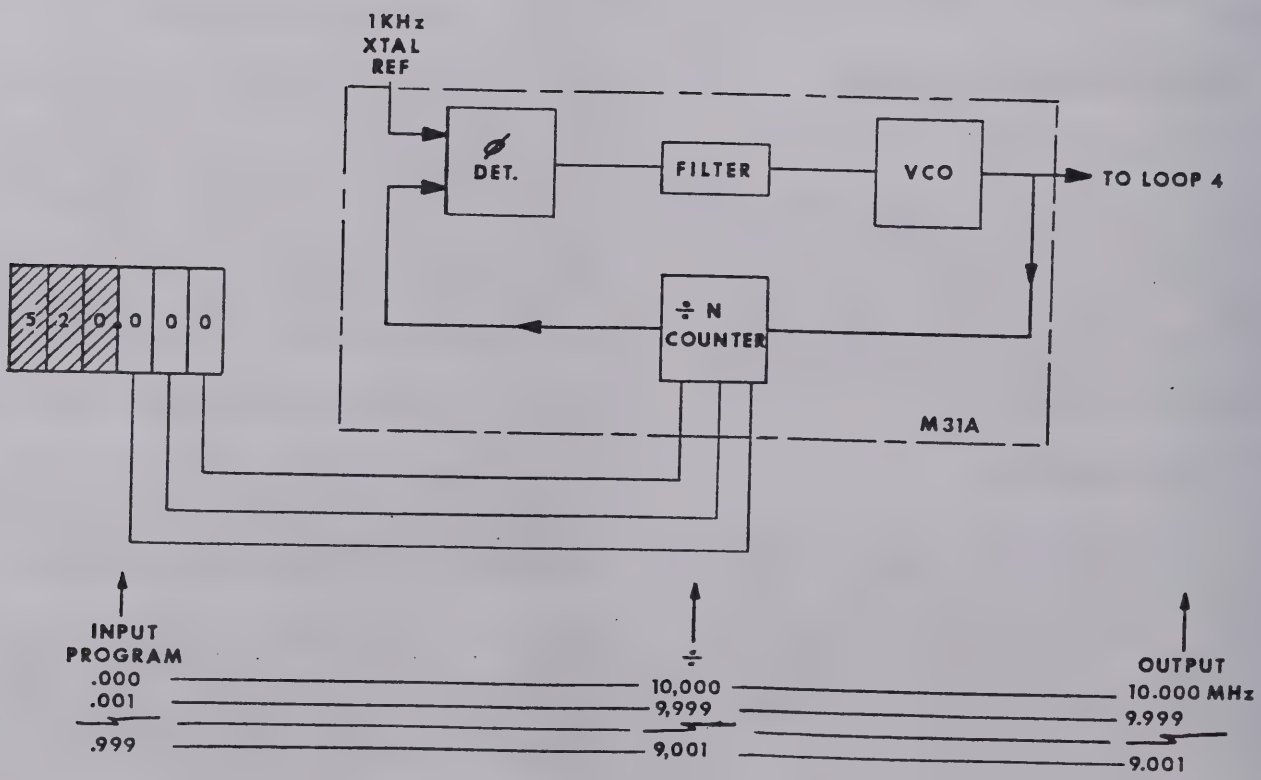


Figure 3-3 Phase-Locked Loop 1

compared to a DC reference by the error amplifier. The output of the error amplifier is fed to a PIN diode (voltage-variable) attenuator which changes the input level to the amplifier until the monitored signal produces a DC level equal to the reference level.

3.2.4 LEVEL CONTROL AND AM

The circuitry for controlling the RF output level is directly related to the leveling system because changing the DC level reference changes the RF output level.

Of the 150 dB output range, 130 dB is passive attenuation. The remaining 20 dB is controlled by changing the level reference.

Since the RF level can be voltage controlled, AM can be accomplished by applying the modulating signal to the leveling circuit. This causes the reference voltage to the error amplifier to change at the frequency of the modulating signal. The modulating signal is taken from either an internal oscillator or an external source.

3.3 PHASE-LOCKED LOOPS

The RF generation circuitry discussed above has a frequency range of 1 to 520 MHz, has an output voltage which is leveled and adjustable, and has the ability to be amplitude modulated. With the above circuitry, however, the frequency accuracy is only 3 MHz with 1 MHz resolution. To achieve the desired resolution and accuracy, the instrument includes five phase-locked loops (PLL).

PLL 1, 2, and 4 are used to stabilize the wide oscillator and tune it in 1 kHz steps. The wide oscillator is part of PLL 4. PLL 1 and 2 convert the digital input to reference frequencies for PLL 4.

PLL 3 and 5 provide stabilization to the narrow oscillator and allow FM operation. The narrow oscillator is part of PLL 3. PLL 5 converts a modulating signal (if present) to a reference frequency for PLL 3.

Figure 3-2 illustrates the relationships between the five phase-locked loops.

3.3.1 PLL 1

The purpose of PLL 1 is to generate a CW signal which changes in 1 kHz steps from 10.000 to 9.001 MHz as the output frequency selector is stepped from .000 MHz to .999 MHz. This signal will be used as a reference for PLL 4.

Figure 3-3 shows a simplified block diagram of PLL 1. It includes a voltage-controlled oscillator capable of frequencies from 9 to 10 MHz, a phase detector, and a divide-by-N counter. A sample of the output signal from the VCO is fed to a programmable counter. The divisor of the counter is controlled by the kHz portion (3 digits) of the selected output frequency. The output from the counter is fed to a phase detector where it is compared to a 1 kHz signal from the Crystal Reference module. If the two input signals to the phase detector are not the same frequency, an error signal is produced. This error voltage corrects the frequency of the VCO until the phase detector input from the counter is exactly 1 kHz.

3.3.1.1 M31A kHz STEPS

PLL 1 consists mainly of module M31A. The input to this module is the BCD data from the kHz portion of the FREQUENCY selector.

The module output frequency is (10,000-Sk) kHz, where Sk is the number indicated by the kHz portion. If the output frequency is set to

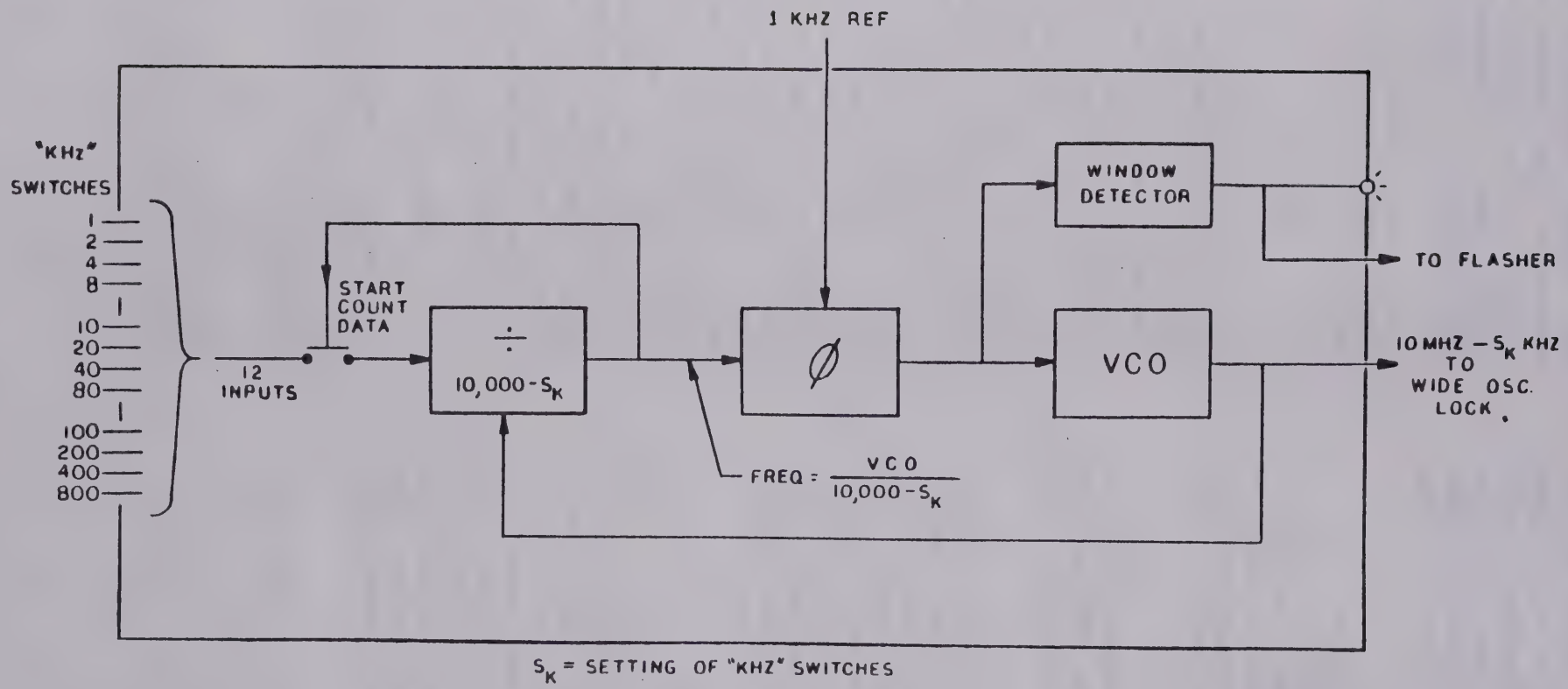


Figure 3-4 M31A kHz Steps

510.333 MHz, for example, the M31A output is 9.667 MHz (10,000-333 kHz). The block diagram of the M31A is shown in Figure 3-4.

VCO

The output frequency is generated by a voltage-controlled oscillator which is tuneable from 9.001 to 10.000 MHz. The VCO tuning voltage comes from the phase/frequency detector circuit. A 1 kHz signal from the Crystal Reference module is applied to one input of phase detector IC9. A sample of the VCO output is divided by the programmable divider, and the result is applied to the other input of the phase detector. Any difference in phase or frequency in the signals applied to the phase detector inputs produces an error voltage at the phase detector output, which controls the VCO. The system is stable only when the phase and frequency error is zero. so that the output frequency is phase locked to the 1 kHz reference signal.

PROGRAMMABLE DIVIDER

The programmable divider is designed to divide the VCO frequency by (10,000-Sk) where Sk is the number indicated by the kHz portion. The divider counts the number of cycles at its input and puts out a pulse when the count reaches 10,000. The starting count is the number of the kHz portion. For example, if the instrument is set for 222.547 MHz, this circuit would divide by 9,453 (count from 453 to 10,000). Therefore, the variable input to the phase detector would be correct (1 kHz) only if the VCO output were 9.453 MHz.

UNLOCK INDICATOR

When the phase-locked loop is unlocked, the LED on top of the module will light and the front-panel ACCURACY lamps will flash.

A window detector monitors the voltage level being fed from the phase detector to the VCO. If the voltage exceeds the normal operating range, power is applied to the module lamp and the flasher circuit on the Modulation Board.

3.3.2 PLL 2

The purpose of PLL 2 is to generate a CW signal which changes in 1 MHz steps from 1448 to 1487 MHz when the output frequency is stepped from 001 to 039 MHz. These CW steps are then repeated every 40 MHz throughout the entire 1 to 520 MHz range. Use of this signal to control the wide oscillator will be discussed in the description of PLL 4.

Figure 3-5 shows a simplified block diagram of PLL 2. PLL 2 operates in the same manner as PLL 1 with one exception; the circuit includes a mixer and bandpass amplifier. The purpose of this additional circuit is to offset the 1448 to 1487 MHz output from the VCO to 8 to 47 MHz. This offset is necessary in order to make the frequency compatible with the programmable counter and phase detector circuits. The other circuits in this loop operate in the same way as those in PLL 1. In this case, the programmable counter is controlled by the MHz portion of the output frequency and the loop reference frequency is 1 MHz.

3.3.2.1 M32A MHz STEPS

PLL 2 consists mainly of module M32A. The input to this module is the BCD data from the MHz portion of the FREQUENCY selector. The module output frequency is (1448+R) MHz where R is the remainder of dividing the MHz portion number (Sm) by 40. For example, if the output frequency selected is 333.000, R would be 13 (333 divided by 40 = 8 with a Remainder of 13). The output of the M32A would then be 1448 + 13 = 1461 MHz. The block diagram of the M32A is shown in Figure 3-6.

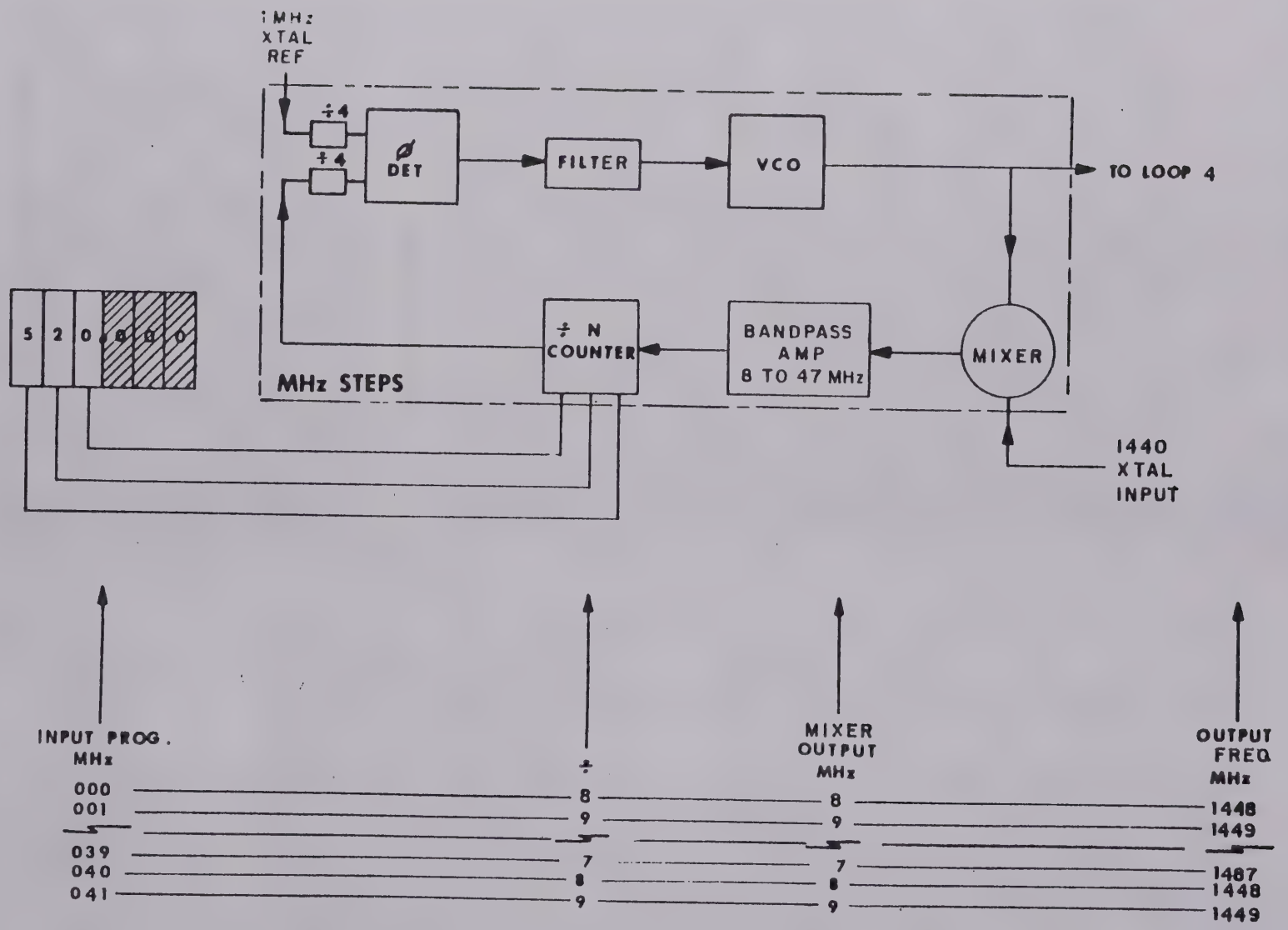


Figure 3-5 Phase-Locked Loop 2

VCO

The output of the M32A is produced by a voltage-controlled oscillator. This VCO is coarsely tuned by the repeating analog output of the Sweep Drive/DAC module. Fine tuning is the result of including the VCO in the phase-locked loop.

PROGRAMMABLE DIVIDER

A sample of the VCO output is mixed with the 1440 MHz signal from the Crystal Reference module producing a difference frequency of from 8 to 47 MHz, which is then shaped into TTL pulses and applied to the programmable divider.

The divider counts the falling edges of the 8-47 MHz input pulses, resetting each time a count of 47 is reached. The reset pulse is applied to one input of the phase detector. By controlling the starting count of the programmable divider, the effective divisor can be controlled.

The starting count of the programmable divider is selected by a read-only memory, which is programmed to provide the correct R information for each Sm setting. This R is then applied to the programmable divider as the starting count. Thus, as the starting count varies from 0 to 39, the effective divisor varies from 47 to 8.

When the VCO frequency is correct, the programmable divider reset pulse rate will be 1 MHz.

PHASE DETECTOR

One input to the phase detector is the reset pulse from the programmable divider. The other input is a 1 MHz fixed reference signal from the Crystal Reference module. The phase detector output is a voltage determined by the difference in phase at the phase detector inputs, and is used to correct any error in the VCO frequency or phase.

If the VCO output frequency is too high, for example, the phase detector output becomes more negative, thus increasing the VCO varactor diode tuning capacitance and lowering the VCO frequency. If the VCO frequency is too low, the reverse occurs. Thus, the loop will tend to maintain zero phase or frequency error. A voltage-controlled attenuator between the phase detector circuit and the VCO keeps the open-loop gain of the phase-locked loop relatively constant over the programmed frequency range, allowing the loop noise to be minimized.

UNLOCKED INDICATOR

When the phase-locked loop is unlocked, the LED on top of the module will light and the front-panel ACCURACY lamps will flash.

A window detector monitors the voltage level being fed from the phase detector to the VCO. If the voltage exceeds the normal operating range, power is applied to the module lamp and the flasher circuit on the Modulation Board.

3.3.3 PLL 4

The purpose of PLL 4 is to adjust the wide oscillator in 1 kHz steps from 1199 MHz to 1718 MHz according to the RF output frequency selected.

The wide oscillator frequency is offset by mixers 1 and 2 and compared to the reference (from PLL 1) by the phase detector. A difference in phase or frequency causes an error signal to tune the wide oscillator until both phase detector inputs are identical. How this loop locks on a particular frequency can best be explained in three steps: 1) phase locking at 40 MHz intervals across the band; 2) phase locking at 1 MHz intervals; 3) phase locking at 1 kHz intervals. Figure 3-7 is a simplified block diagram of PLL 4.

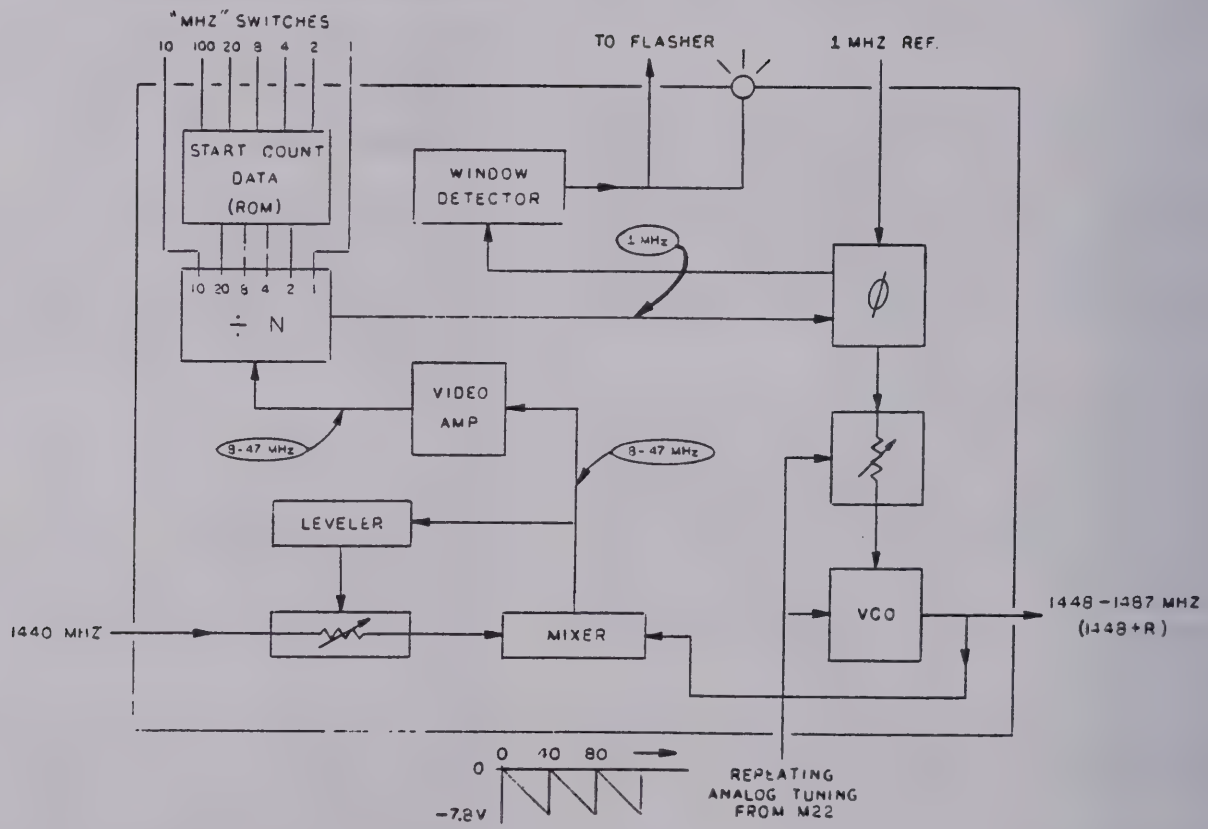


Figure 3-6 M32A - MHz Steps

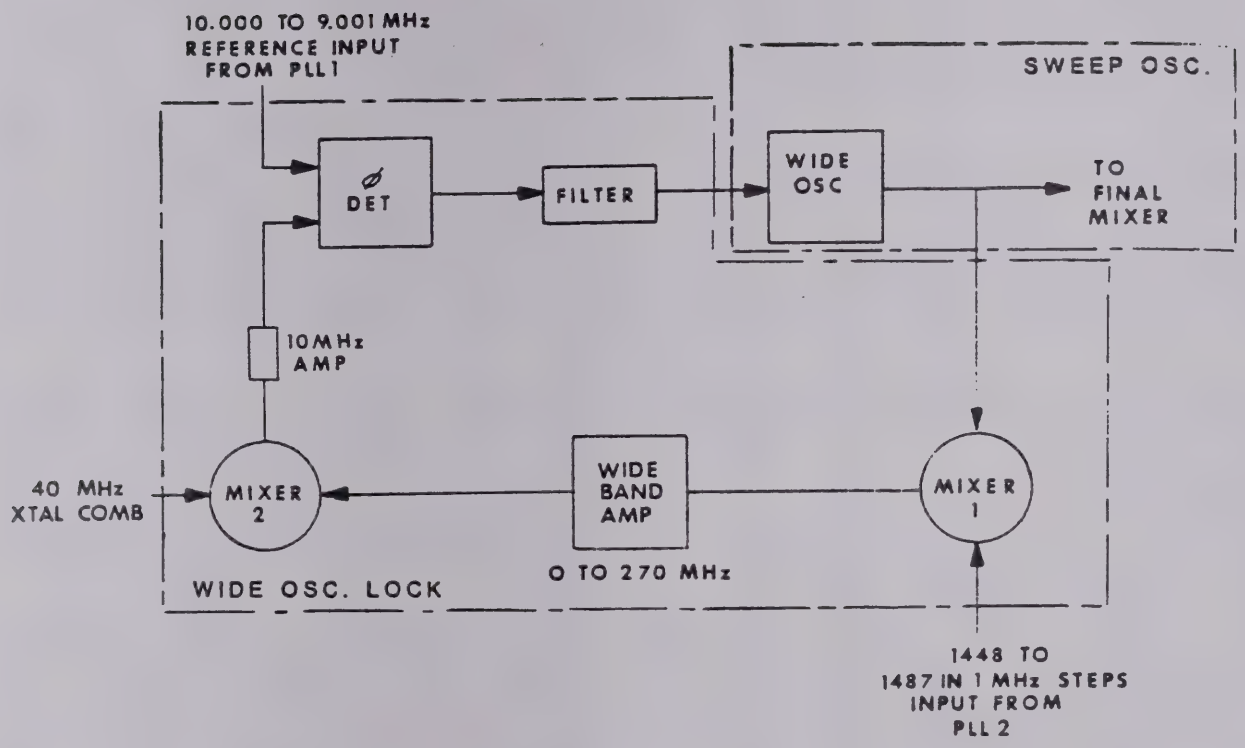


Figure 3-7a. Phase-Locked Loop 4

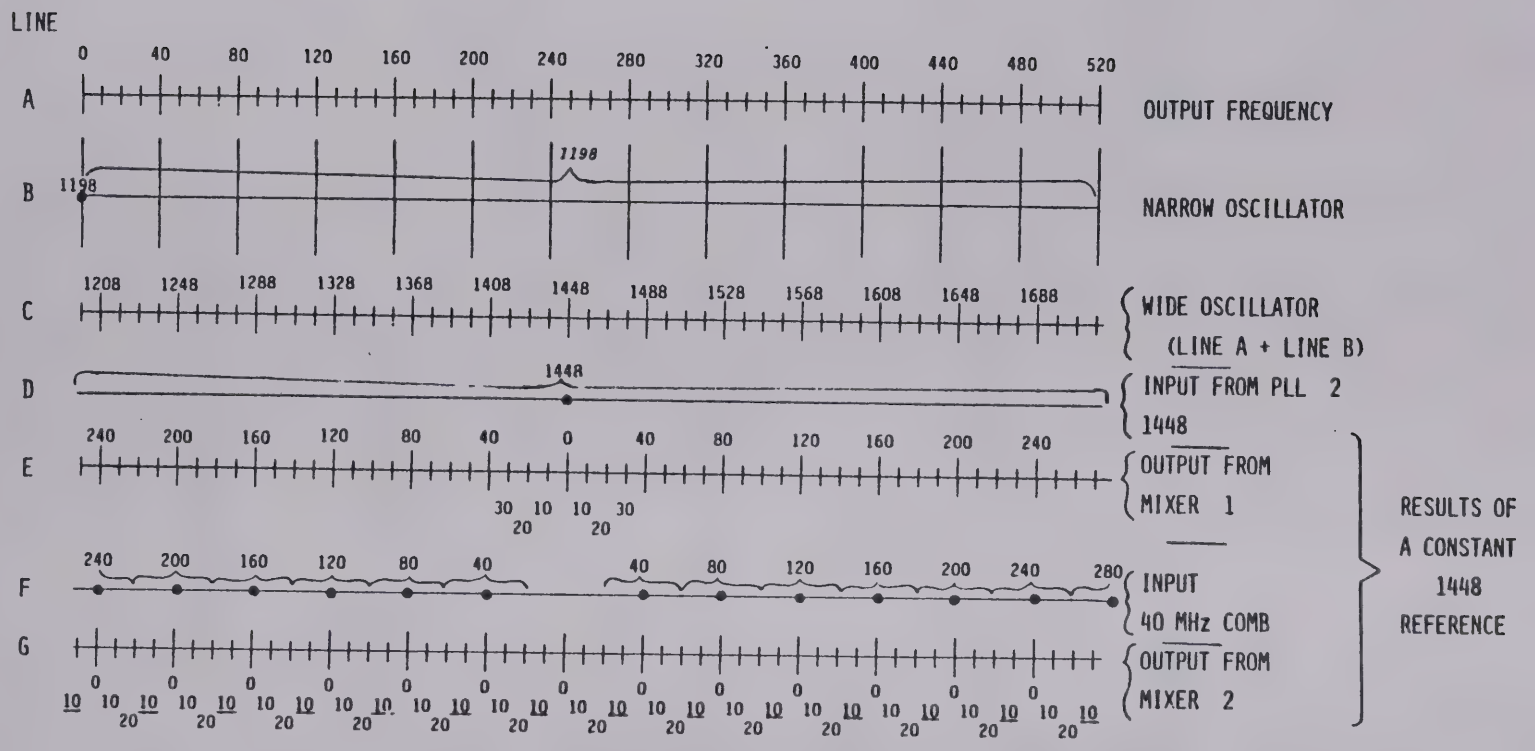


Figure 3-7b. Phase-Locked Loop 4

To understanding locking at 40 MHz intervals, assume temporarily that the reference frequencies from PLL 1 and PLL 2 are fixed (10 MHz and 1448 MHz respectively). Figure 3-7 shows the frequencies throughout the loop for this discussion. This step of the PLL 4 explanation can be described more clearly by considering the entire wide oscillator range rather than discussing single frequencies. The wide oscillator covers the range of 1199 to 1718 MHz as the output frequency changes from 1 to 520 MHz (lines A and C).

When the oscillator range is heterodyned in mixer 1 with 1448 MHz, the difference frequency produced ranges from 250 to 0 to 270 MHz (line E). This signal is then mixed with a 40 MHz comb (all harmonics of 40 MHz) in mixer 2 (line F). Taking the difference between lines E and F yields the repetitive frequency range from 0 to 20 to 0 MHz (line G). This signal is fed to the phase detector.

The reference to the phase detector is 10 MHz, but the loop will not lock on every 10 MHz output of mixer 2. The only 10 MHz signals which will produce lock are those which would decrease in frequency if the wide oscillator tried to drift higher. Therefore, at every 40 MHz interval of the output frequency, an input to the phase detector would allow the loop to lock. Section 3.2.1 explains that an analog signal drives the wide oscillator to within 3 MHz of the proper frequency. Therefore, although there are 14 possible lock points on line G, the only one selected will correspond to the analog-tuned frequency of the wide oscillator. The unit as described so far is capable of phase-locked output at 40, 80,...520 MHz. The following is an explanation of locking at 1 MHz intervals.

To allow phase locking at 1 MHz intervals, the reference frequency to mixer 1 is made adjustable in 1 MHz steps over a 40 MHz range (1448-1487 MHz). If, for example, this reference frequency to mixer 1 were 1449 MHz, the input range to the phase detector would look the same, except that the entire range would be shifted by 1 MHz. Lock points would then be possible at output frequencies of 1, 41, 81,...481 MHz. Being able to change this reference in 1 MHz steps allows phase locking from 1 to 520 MHz in 1 MHz steps.

To provide phase locking in 1 kHz steps, the PLL 4 phase detector reference from PLL 1 is adjustable in 1 kHz steps (10.000 to 9.001 MHz). This causes the wide oscillator frequency to change in 1 kHz steps in order to maintain lock.

3.3.3.1 M34 WIDE OSCILLATOR LOCK

PLL 4 is contained mainly in module M34, although the VCO for the loop is the wide oscillator located in the Sweep Oscillator module.

Figure 3-8 is the block diagram of the M34. The letters A thru F relate the signals at the associated points in the module to the graphs A through F in Figures 3-9 and 3-10. The M34 phase locks the wide oscillator to 1198 MHz plus the output frequency selected. The frequency offset circuit converts the frequency of the VCO to a lower frequency which retains the frequency error information for use by the phase detector. In addition to the frequency offset circuit and the phase detector, several auxiliary circuits are included.

PHASE DETECTOR

The phase detector compares the offset wide oscillator frequency to the reference frequency from the kHz Steps module in PLL 1. The phase detector output voltage goes positive or negative to ultimately drive the wide oscillator higher or lower in frequency until both inputs to the phase

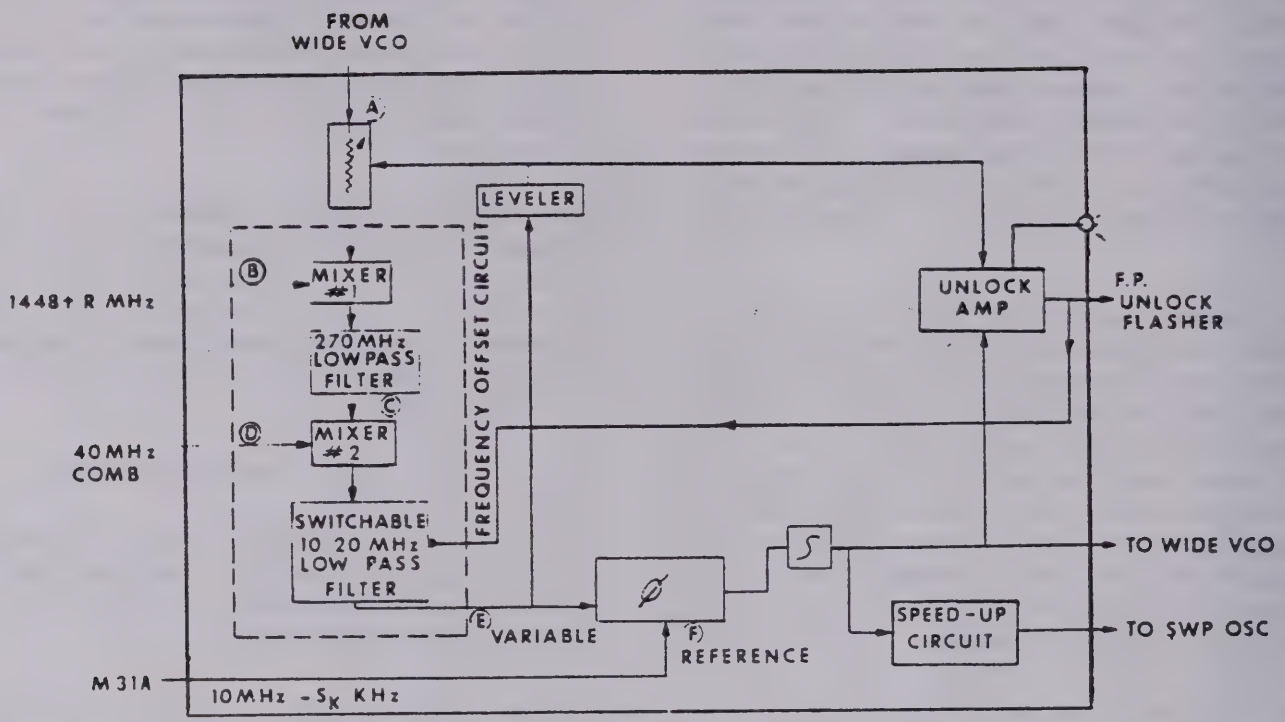


Figure 3-8 M34 Wide Oscillator Lock

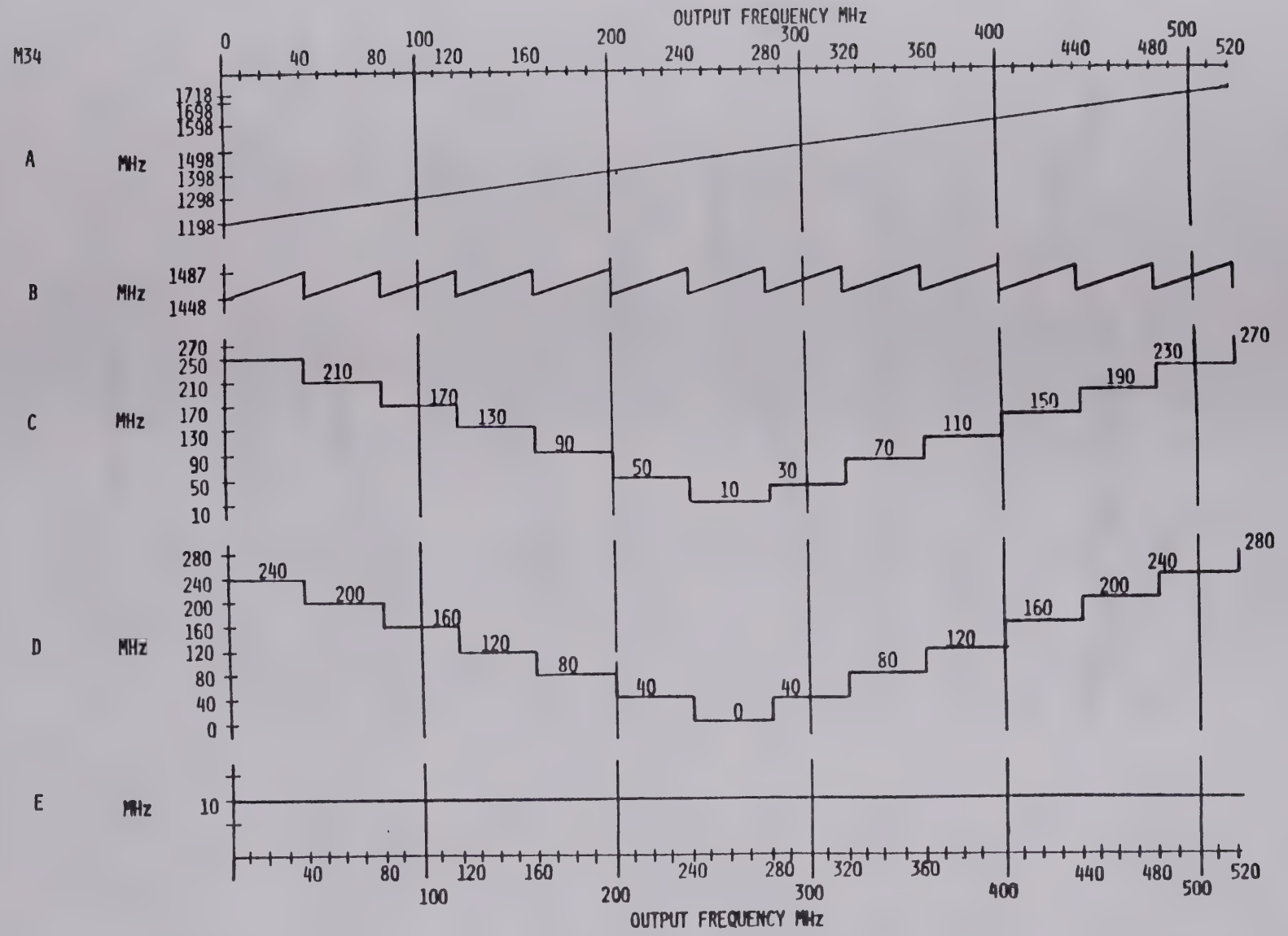


Figure 3-9 M34 Frequencies

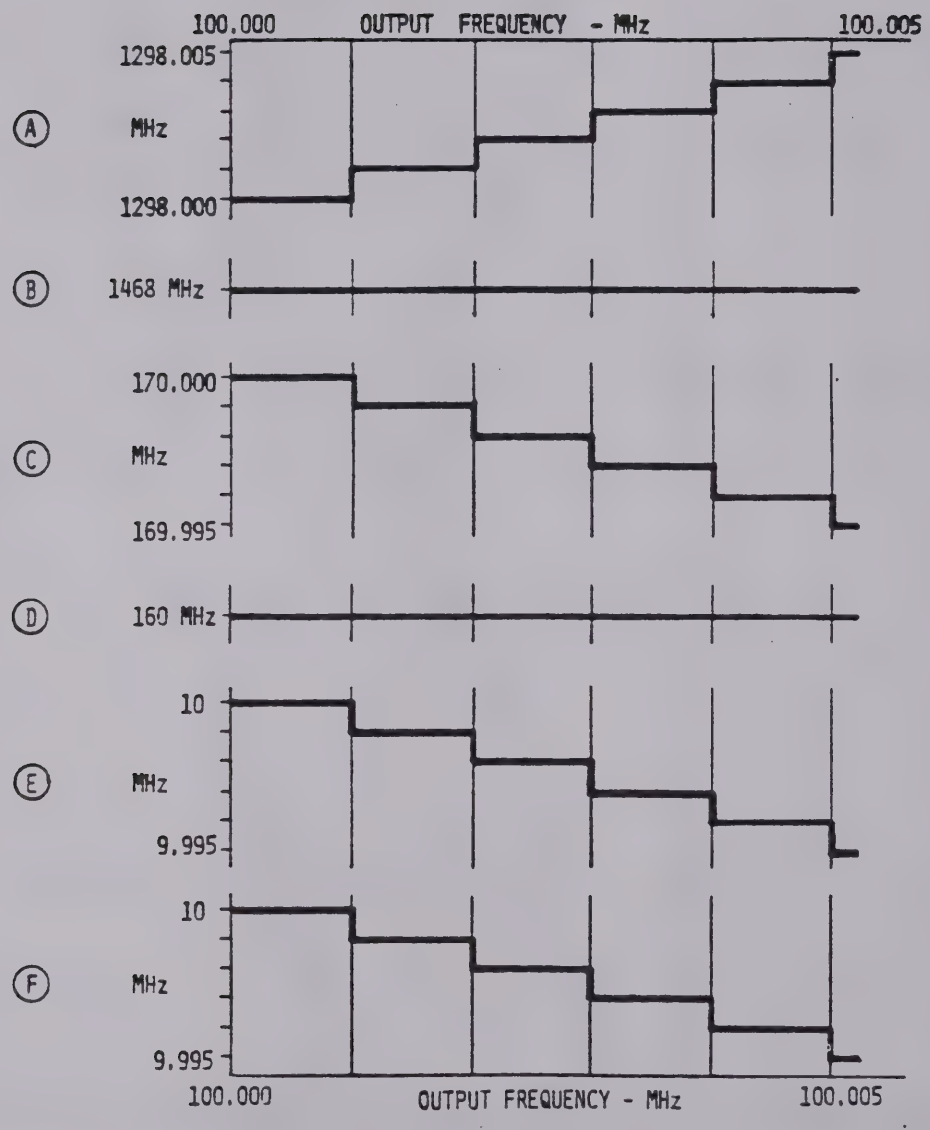


Figure 3-10. M34 Frequencies (Expanded)

detector are the same frequency. The integrator serves as a lowpass filter for the phase detector.

FREQUENCY OFFSET CIRCUIT

The wide oscillator error information must be converted to a frequency useable by the phase detector. This conversion is made by mixer 1, a 270 MHz lowpass filter, mixer 2, and a 10 MHz lowpass filter. Refer to Figures 3-8, 3-9, and 3-10 for signal descriptions.

Mixer 1 heterodynes the wide oscillator frequency with the reference frequency (1448 + R MHz). The difference frequency,]1448 + R - WO[is below 270 MHz. This signal is sent to mixer 2 where it is heterodyned with the 40 MHz comb. For any output frequency, graph D in Figure 3-9 shows the comb frequency which will yield the desired output (below 20 MHz) of mixer 2. If PLL 4 is locked, mixer 2 will produce a 10 MHz difference as shown in Figure 3-9 (assuming the kHz portion is 000). Figure 3-10 shows signals A thru F for a case when the kHz portion is not 000.

The filter after mixer 2 blocks all the outputs of the mixer except the lower-frequency signal containing the wide oscillator error information. When the unit is unlocked, the filter passes up to 20 MHz (to be able to capture over the 20 MHz range allowed for analog tuning). Once PLL 4 is locked, the filter decreases to 10 MHz to further eliminate phase-locked loop-related spurious signals.

AUXILIARY CIRCUITS

The "speed-up" circuit is activated when the phase-locked loop becomes unlocked. The output of this circuit is sent to the Sweep Oscillator module to cause the wide oscillator to be tuned faster. The unlock amplifier monitors both the tuning voltage from the phase detector and the leveler voltage to detect an unlocked condition of the M34. When unlock occurs, it turns on the module lamp and sends a voltage to the flasher circuit on the Modulation Board.

The leveler circuit maintains a constant input amplitude to the phase detector by controlling the amplitude of the input from the wide oscillator. The input to the phase detector (approximately 10 MHz) is peak detected and compared to a DC reference in the leveler circuit. The leveler circuit controls a PIN diode attenuator between the wide oscillator input and mixer 1.

3.3.4 PLL 3

The purpose of PLL 3 is to stabilize the narrow oscillator at a frequency of 1198 MHz.

Figure 3-11 shows a simplified block diagram of PLL 3. This loop operates in the same manner as PLL 1 and PLL 2, except that it does not require the use of a programmable counter. The 1198 MHz output from the narrow oscillator is combined in a mixer with a 1200 MHz crystal-controlled signal producing a 2 MHz difference signal. This signal is fed to a phase detector where it is compared to a 2 MHz reference. Any difference in the input signals will produce an error voltage which is applied to the narrow oscillator to correct the frequency error.

3.3.4.1 M33-2 NARROW OSCILLATOR LOCK

PLL 3 is contained mainly in module M33-2, although the VCO for the loop is the narrow oscillator in the Sweep Oscillator module. The M33-2 block diagram is shown in Figure 3-12.

PHASE DETECTOR FOR PLL 3

This circuit compares the reference frequency to the variable frequency which represents the narrow oscillator output. If the frequency is too high, for example, the phase detector puts out a more positive voltage which

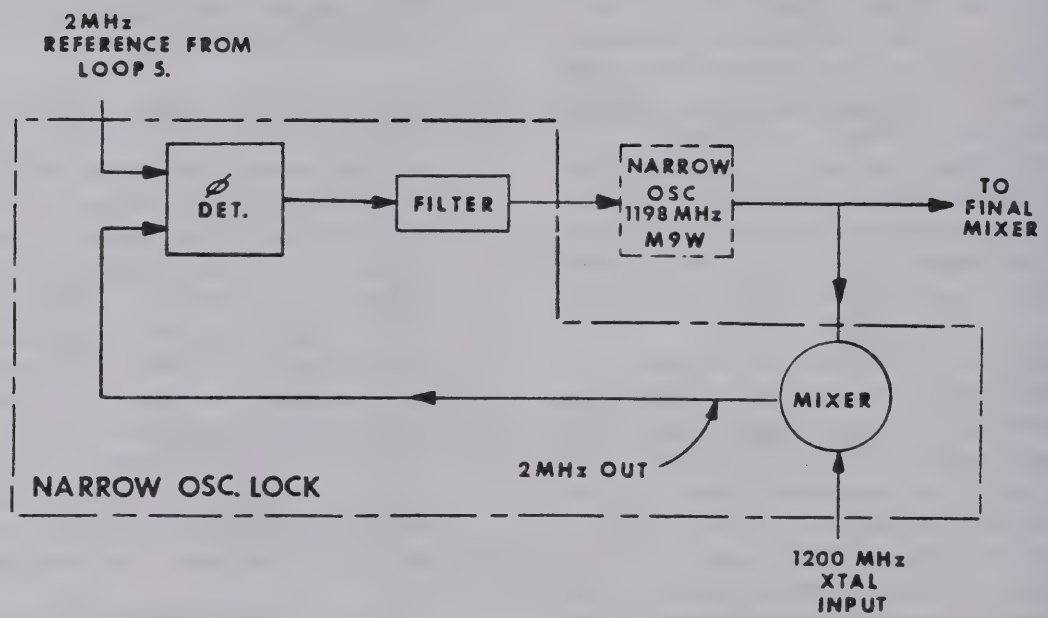


Figure 3-11 Phase-Locked Loop 3

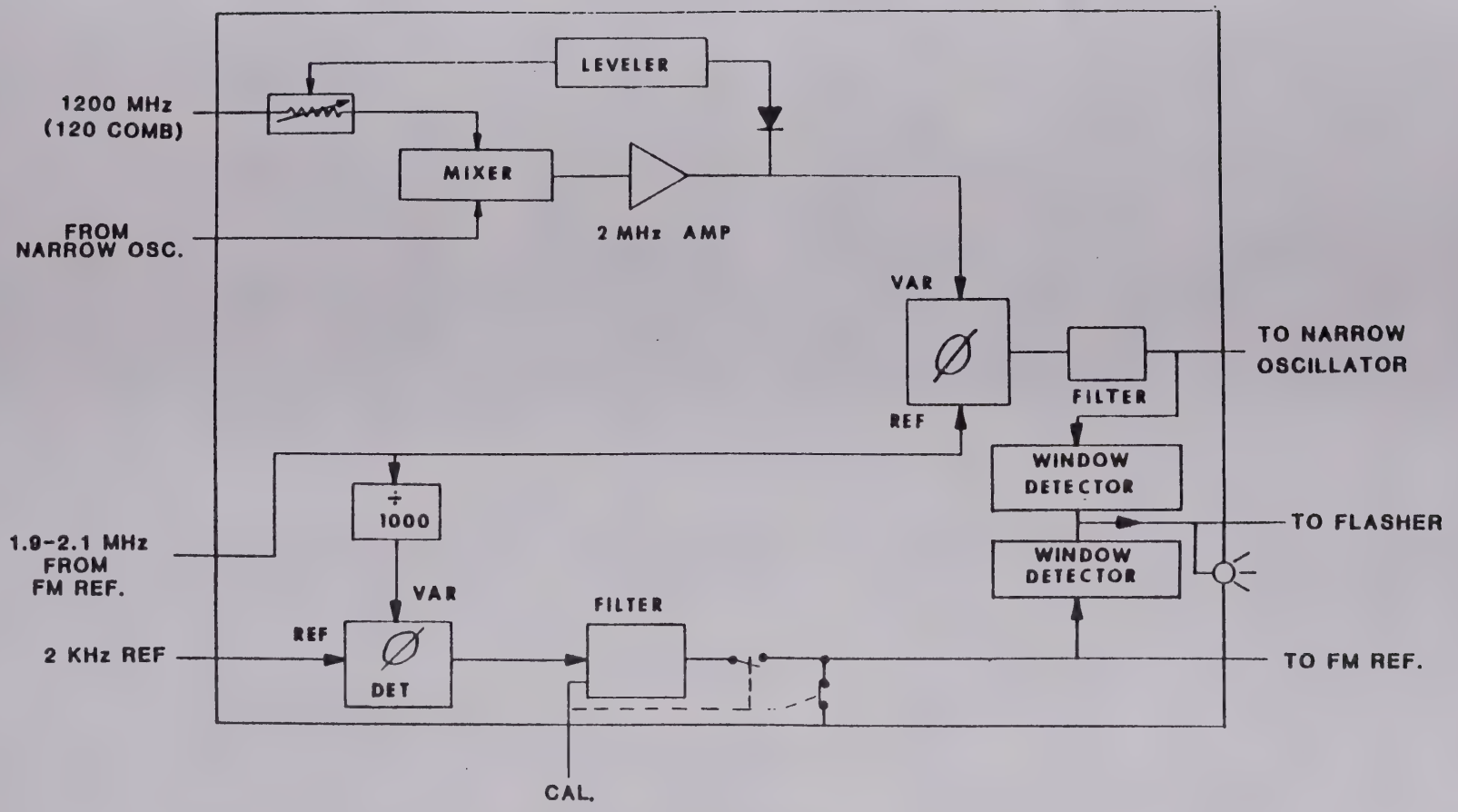


Figure 3-12 M33-2 Narrow Oscillator Lock

is filtered and inverted by an integrator, and applied to the narrow oscillator to lower the frequency.

MIXER

The phase detector cannot operate at UHF frequencies, so the narrow oscillator signal is mixed with a 1200 MHz CW signal from the Crystal Reference module. This provides an offset frequency which is the variable input to the phase detector. The deviation of this variable signal from 2 MHz is precisely the same as the deviation of the VCO from 1198 MHz.

UNLOCK INDICATOR

The unlock indicator lamp in the M33-2 is shared by PLL 3 and PLL 5. A window detector monitors the integrator output voltage. If the voltage exceeds the normal operating range, power is applied to the module lamp and to the flasher circuit on the Modulation Board.

3.3.5 PLL 5

PLL 5 supplies the reference for PLL 3. Unlike a standard phase-locked loop, the VCO can be modulated. In AM and CW modes, the VCO is locked to 2 MHz. In the FM mode, the VCO is modulated, but the loop ignores modulation which is faster than 50 Hz; thus the center frequency remains locked.

Figure 3-13 shows a simplified block diagram of PLL 5. The loop includes a voltage-controlled oscillator, a divider for reducing the frequency from 2 MHz to 2 kHz, a phase detector, and a filter for the phase detector output. If the variable input to the phase detector deviates from the reference frequency (slower than 50 Hz), the phase detector sends an error signal to the VCO to correct the frequency.

3.3.5.1 M29-2 FM REFERENCE

PLL 5 is contained in modules M29-2 and M33-2, with an input from the FM circuitry. The block diagrams are shown in Figures 3-14 and 3-12, respectively.

The M29-2 is a voltage-to-frequency converter, the output of which is used as a phase lock reference in the Narrow Oscillator lock module. The M29-2 includes a voltage-variable current source which feeds (determines the frequency of) a square wave oscillator. Zero volts in yields 2 MHz out.

The M29-2 is the VCO for PLL 5. The input to the M29-2 from the phase detector is essentially added to the modulation input.

CURRENT SOURCES

This circuit provides both a positive and a negative source of current. The positive source is referenced to the negative source so that the instantaneous currents in both sources are equal.

The change in output current is directly proportional to the change in input voltage to the circuit. The input voltage may vary between -5 and +5 volts. The circuit is designed for a very linear relationship of current-out vs. voltage in.

OSCILLATOR

The square wave output is produced by the combination of an integrator and a hysteresis switch. The integrator converts a square wave to a triangle wave. The triangle wave causes the hysteresis switch to produce the square wave which is fed back to the integrator.

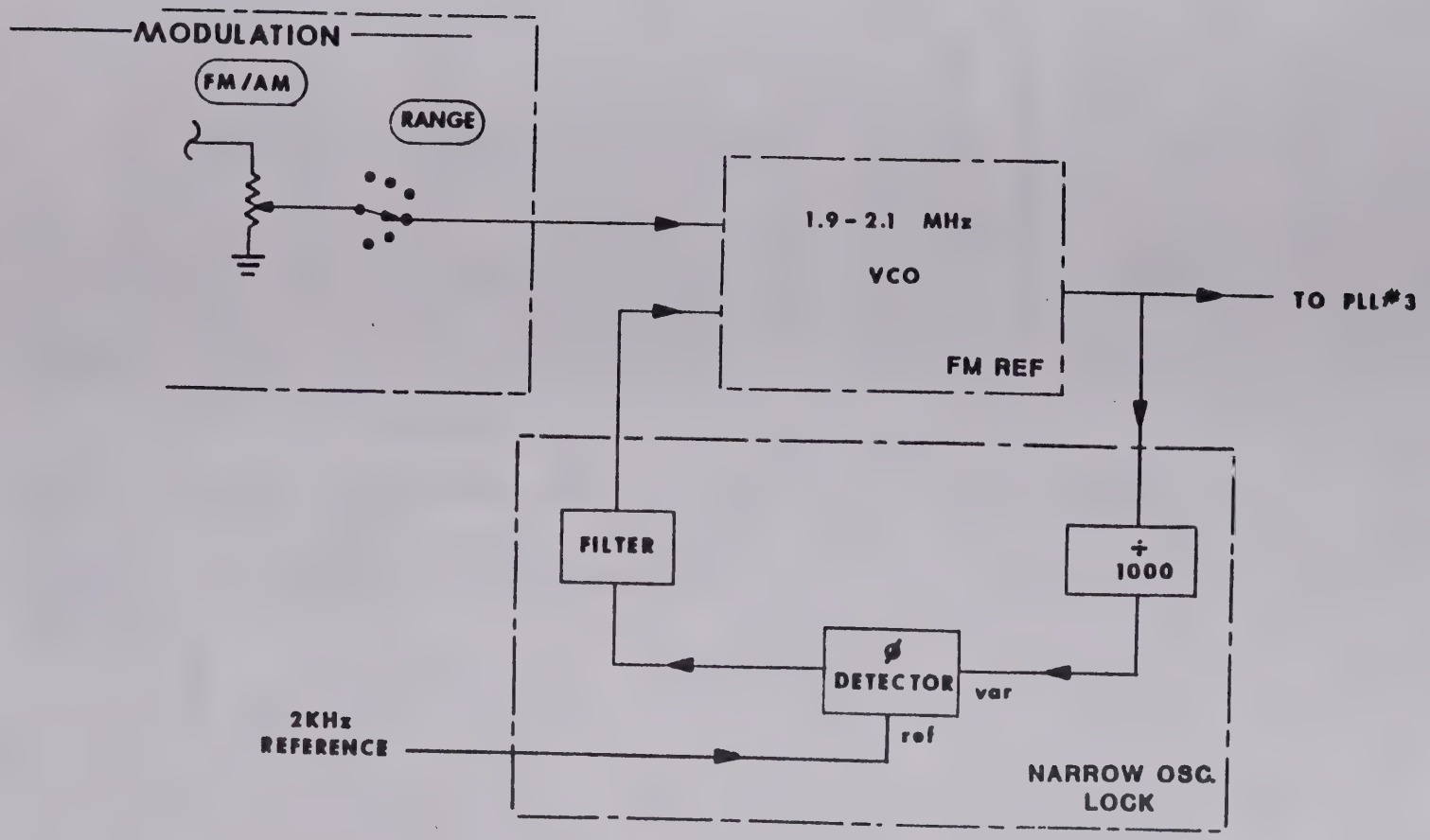


Figure 3-13 Phase-Locked Loop 5

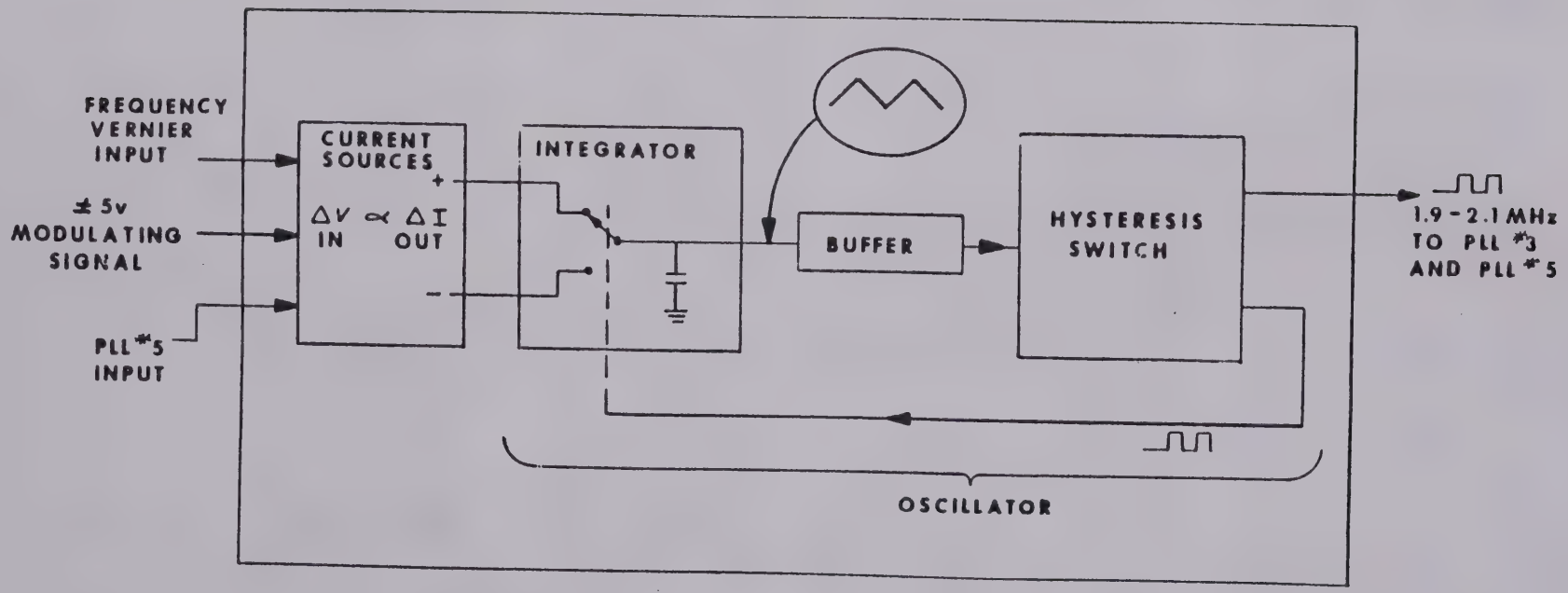


Figure 3-14 M29-2 FM Reference

The integrator is made up of a current switch and a capacitor. The square wave applied to the current switch causes a square current signal to be applied to the capacitor.

Positive constant current produces an increasing voltage ramp on the capacitor, while negative constant current produces a decreasing voltage ramp. For a square wave input, therefore, the output is a triangle wave.

Changing the magnitude of the currents (by changing the input voltage to the module) changes the rate at which the capacitor charges and discharges to the hysteresis points; thus changing the frequency of oscillation.

TUNE AND DEVIATION MEASUREMENT MODES

In tune and deviation measurement modes, the M29-2 is phase locked to the input signal. The loop control voltage is thus proportional to the input signal deviation.

3.3.5.2 M33-2 NARROW OSCILLATOR LOCK

Module M33-2 contains the phase detector for PLL 5. This circuit compares the 2 kHz reference from the Crystal Reference module to the variable frequency which is the FM Reference output divided by 1000. The variable frequency will remain in the capture range of the phase detector. Any frequency modulation (above 50 Hz) is filtered out by the integrator filter, and the error voltage is fed to the FM Reference module.

TUNE AND DEVIATION MEASUREMENT MODES

In the tune and deviation measurement modes, the M33-2 receives the 2 MHz output of the Crystal Reference (through the FM Discriminator module) in order to keep the unit phase-locked in all modes.

UNLOCK INDICATOR

The unlock indicator lamp in the M33-2 is shared by PLL 3 and PLL 5. A window detector is fed by the integrator output. If the integrator puts out a voltage outside its normal operating range, the window detector applies voltage to the module's unlock indicator lamp and to the flasher circuit on the Modulation Board.

3.4 M172 SWEEP DRIVE/DAC

This module provides two output voltages. One is linear from 0 V to -5 V as the frequency goes from 0 to 39 MHz, repeating every 40 MHz; the other varies from +7 V to -8 V as the frequency goes from 1 to 520 MHz. The second voltage is shaped to linearize the wide oscillator. The block diagram for the M172 is shown in Figure 3-15.

Two digital-to-analog converter ICs, programmed by the front-panel Lever/Indicator switches, provide the 1 to 520 MHz voltage. This is shaped in the next section of the module. A third DAC provides the repeating 0 to 39 MHz voltage. Since the state of the 20's line depends on the 100's line, the 20's line is inverted when the 100's line is high.

The analog tuning signal from the M172 is shaped before driving the wide oscillator. The shaper is an inverting DC amplifier which amplifies the input by a smaller factor for smaller magnitude inputs. Shaping this analog voltage compensates for the non-linear change in capacitance of the varactor diodes in the wide oscillator circuit.

3.5 M9W - SWEEP OSCILLATOR

The M9W is the origin of the instrument's RF output frequency. This frequency is generated by heterodyning the signals from two higher frequency voltage-controlled oscillators (see Figure 3-16).

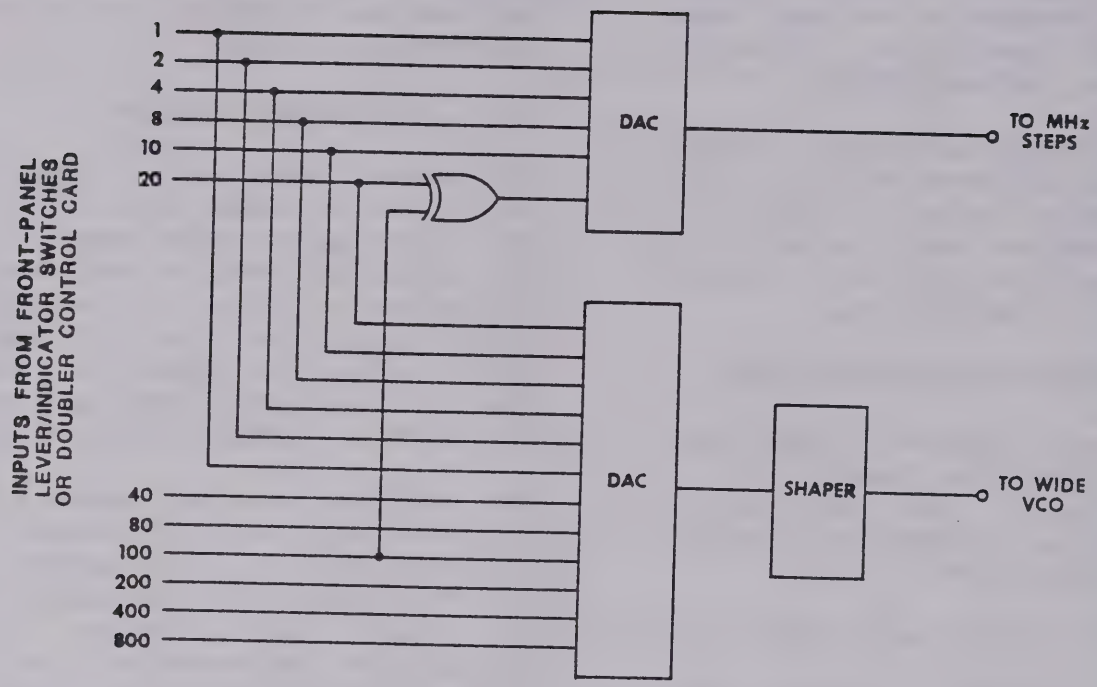


Figure 3-15 M172 Sweep Drive/DAC

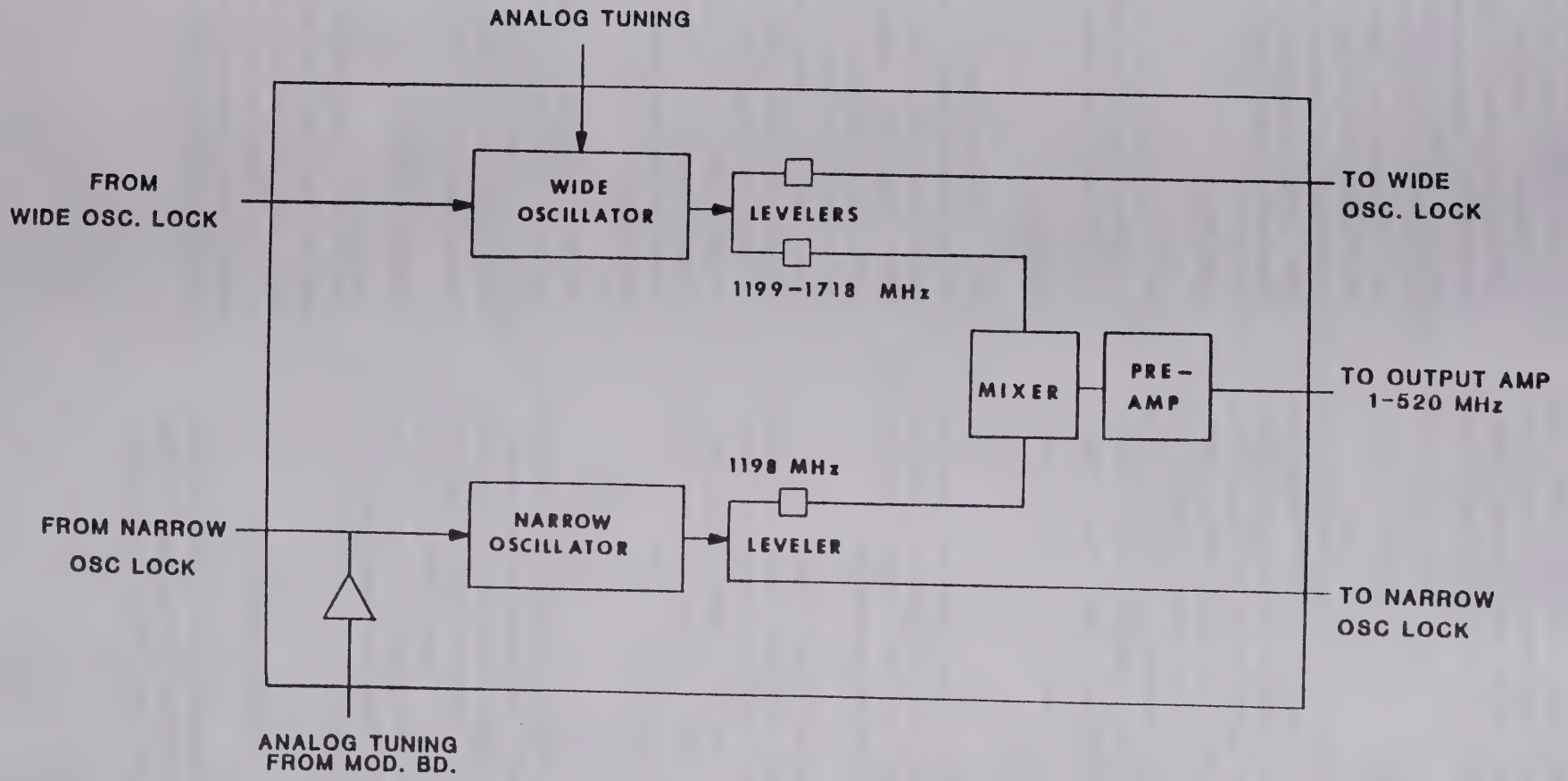


Figure 3-16 M9W Sweep Oscillator

MIXER

The narrow oscillator applies a signal of 1198 MHz to the mixer. The wide oscillator provides between 1199 and 1718 MHz. The difference (1-520 MHz) is applied to a wide band preamplifier and then sent to the Output Amplifier module.

WIDE OSCILLATOR

The wide range of oscillation is achieved by applying to varactor diodes in the tank circuit an analog signal which is dependent upon the output frequency selected. An additional signal is applied to the VCO from the phase detector in PLL 4. This is the fine tuning signal which locks the wide oscillator at the proper frequency.

NARROW OSCILLATOR

This oscillator also uses a varactor diode so that the frequency can be voltage-controlled for phase locking via PLL 3 and for FM operation.

The coarse modulating signal (FM) is applied to the varactor from the Modulation Board. The frequency of this oscillator is further controlled by a fine-tuning bias voltage from the phase detector in PLL 5.

LEVELERS

This module contains three RF leveling circuits. These maintain a constant-amplitude RF signal over the frequency range and with temperature variations. The output of a peak detector is compared to a constant DC level. Any error is amplified and applied to a PIN diode attenuator in series with the RF signal.

3.6 M10W-17 OUTPUT AMPLIFIER

The main function of the M10W-17 Output Amplifier module is to amplify the RF signal from the Sweep Oscillator module to a level programmable between -7 and +13 dBm. A leveler circuit maintains a constant-amplitude output signal over the wide frequency range. A routing circuit directs the Sweep Oscillator module output to the deviation meter circuitry in tune and deviation measurement modes, and a switch circuit directs the RF output to the Down Converter module for output frequencies less than 1 MHz. The UNLEVELED indicator driver causes the UNLEVELED indicator to be enabled when the leveler circuit exceeds its proper operating range (see Figure 3-17).

AMPLIFIER

This section is a four-transistor, wideband amplifier which can increase the RF level by about 23 dB.

LEVELER

The leveler uses a peak detector, differential amplifier, and PIN diode attenuator. The peak detector is fed from the RF output. The resulting level is compared to a DC (or AM) reference by the differential amplifier which supplies the control current to the PIN diode attenuator. If the detected RF output level deviates from the reference level, the signal to the PIN diode causes the input to be decreased or increased, as required.

In addition to providing a flat frequency response, the leveler allows for electronic control of the RF output amplitude by varying the DC reference from the Meter Board.

ROUTING CIRCUIT

The M10W-17 amplifier and leveler are active only in the output mode. In the tune and deviation measurement modes, a PIN diode switch routes the Sweep Oscillator module output to the Amplifier/Mixer module.

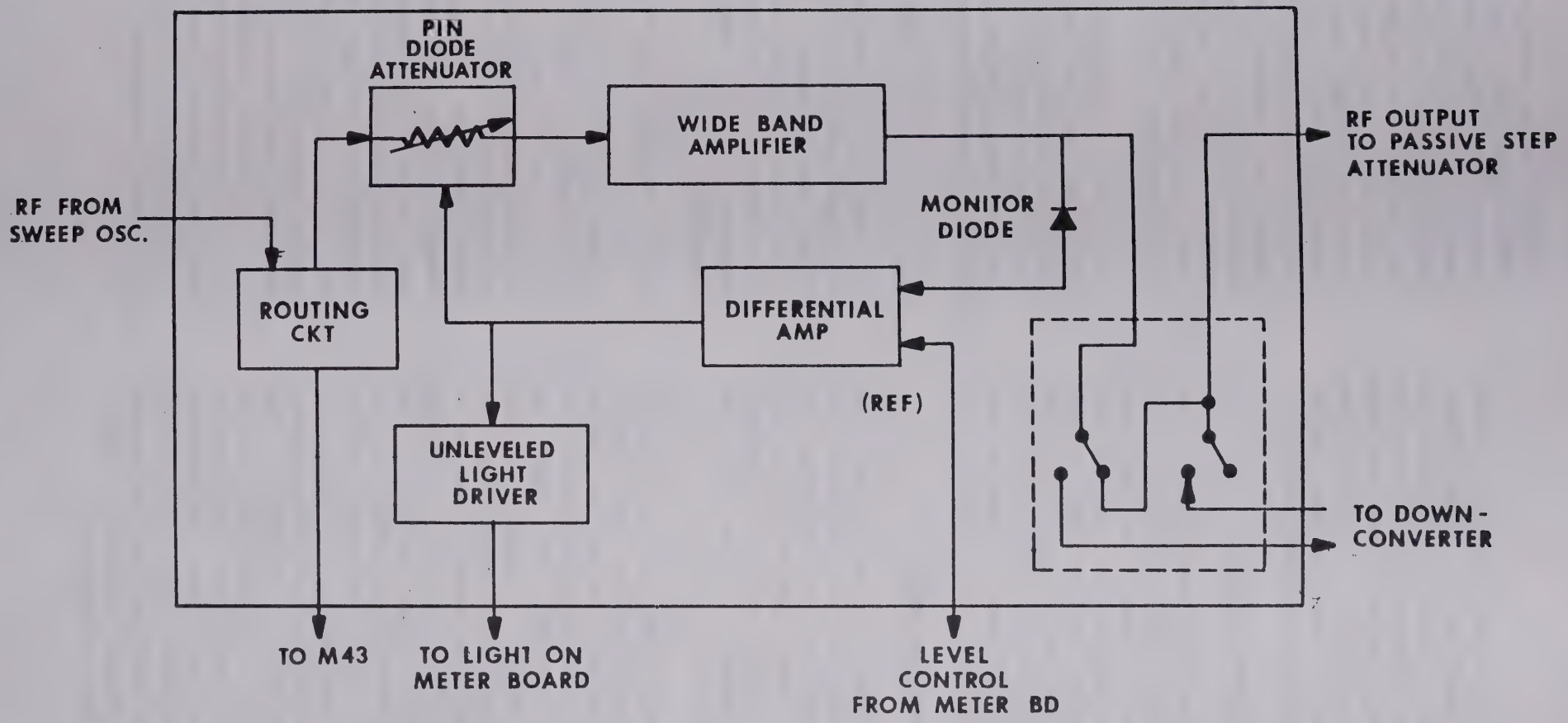


Figure 3-17 M10W-17 Output Amplifier

SWITCH

The switch is normally set to route the output signal to the Step Attenuator; however, when the front-panel MHz selector switches are set to "000", the logic signal from the Down Converter into pin 8 triggers the switch (relay K1) and routes the RF signal to the Down Converter module.

UNLEVELED INDICATOR DRIVER

When the differential amplifier in the leveler circuit is putting out a voltage which would cause the PIN diode attenuator to be at its high or low resistance limit, the leveling circuit can no longer be effective. These extreme voltage levels are applied to the UNLEVELED indicator driver to enable the front-panel LED indicator.

3.7 M115 DOWN CONVERTER

This module takes the RF output from the Output Amplifier module (when the front-panel MHz selector switches are set to "000") and converts it to the proper 1 to 999 kHz output frequency. The block diagram for the M115 is shown in Figure 3-18.

The BCD signals from the front-panel MHz selector switches are fed into a 13-input NAND gate. (Two of the inputs are held high.) This gate determines whether the switches are set for "000", and, if so, triggers a hex inverter to send out a logic "true" to the Output Amplifier module and activates the 10 MHz line to the Sweep Drive/DAC and MHz Steps modules. This programs the Sweep Oscillator for 10 MHz plus the kHz selector switch setting, and this signal is fed into the Output Amplifier. At this point, however, the signal is routed to the M115, where it is mixed with the 10 MHz reference signal from the Crystal Reference module. The difference frequency from this mixing is simply the kHz switch setting, and is output back to the Output Amplifier module and on to the Step Attenuator.

The M115 also contains a 20 dB attenuation pad for the input from the Output Amplifier module and an RF amplifier for the 10 MHz reference signal. The effect of these stages is to allow the mixer output to be directly proportional to the output from the Output Amplifier. The mixer output is then fed into a 3-stage amplifier with complementary push-pull output to restore the output to the proper (-7 to +13 dBm) level. Potentiometer R3 and trimcap C20 fine adjust the gain and frequency response of the module.

If the front-panel MHz selector switches are not set to "000", the M115 has no function, except that the 10 MHz program line from the switches to the Sweep Drive/DAC and MHz Steps modules passes through the M115.

NOTE

If the M115 is removed for servicing, the instrument may still be used; however, the frequency range is reduced from .001-520 MHz to 1-520 MHz. In this case, pins 1 and 9 of the M115 module socket must be jumpered together.

3.8 M35-2 RF OUTPUT PROTECTION

Figure 3-19 is a block diagram of the RF protection circuit.

With the instrument's POWER switch set to OFF, relay K1 is in it's normally open position. This prevents any damage to the instrument while it is not in use. As soon as AC power is applied to the instrument, IC1 will compare the voltage from RF monitor CR1 to a fixed reference voltage of approximately 5 V. As long as the output from the monitor is less than the 5 V reference voltage, the output of IC1 will be approximately +17 V. This positive output from IC1 turns on relay driver Q1. This energizes relay K1, thus completing the RF output circuit.

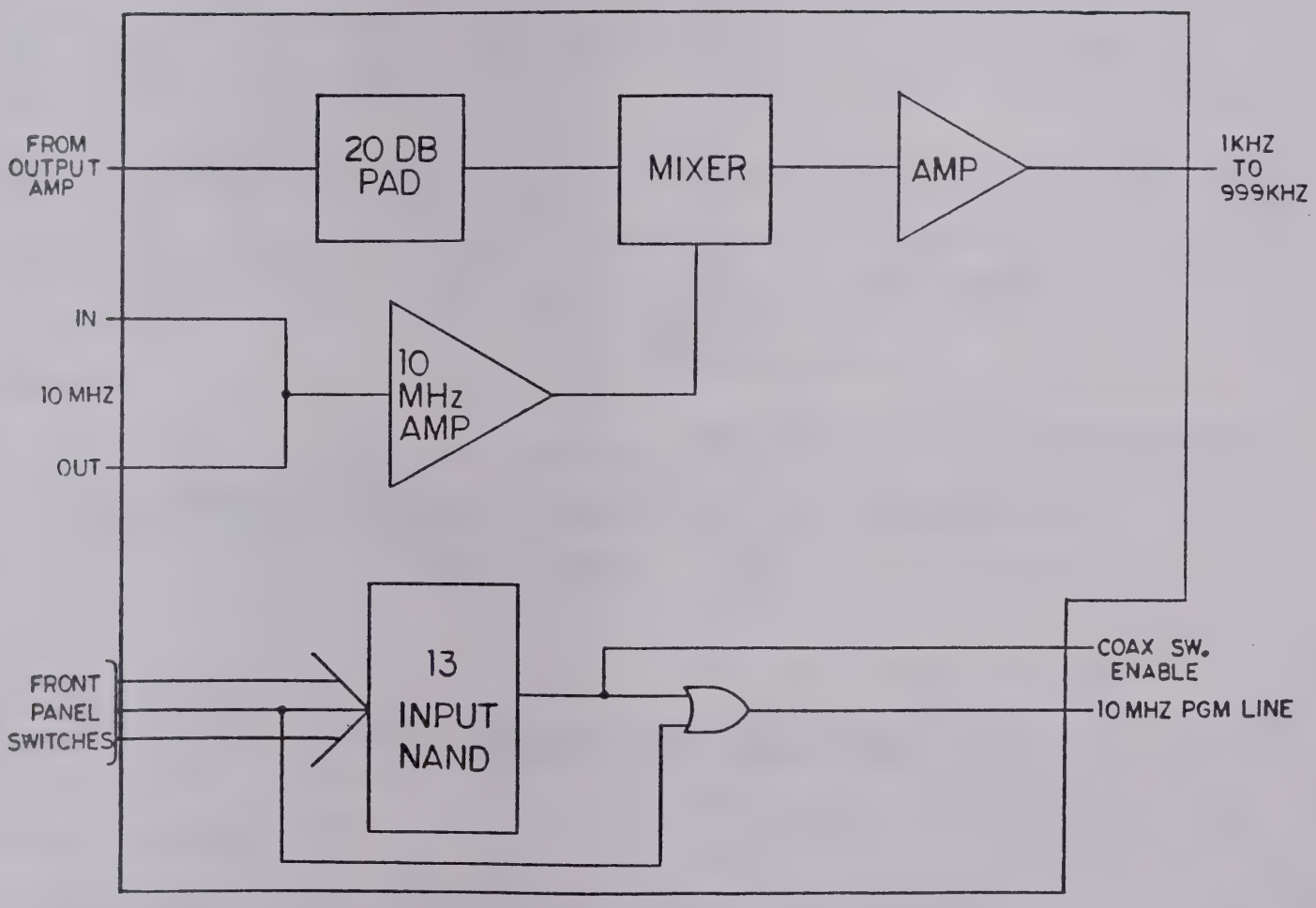


Figure 3-18 M115 Down Converter

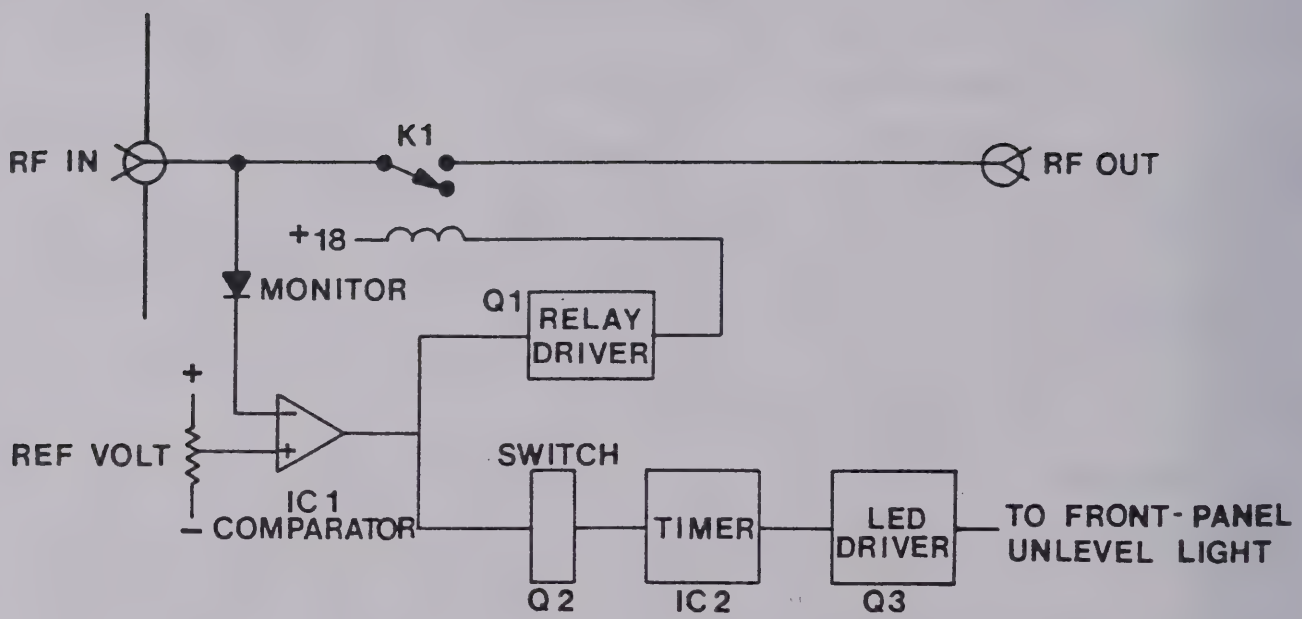


Figure 3-19. M35-2 RF Circuit Breaker

The range calibration circuits convert the voltage from the VERNIER to a voltage level appropriate to drive the leveler circuit in the Output Amplifier module.

The "low" circuit provides the program for all settings of the OUTPUT Step Attenuator control except +10 dBm. At +10 dBm, the level program is taken from the "high" circuit. The "high" level program enables the full gain capabilities of the Output Amplifier module to be used when the RF output is not amplitude modulated.

DEVIATED MEASUREMENT MODE

In the deviation measurement mode, the B006 Meter Board takes the FM Discriminator output signal and converts it (by means of a peak detector) to a METER reading corresponding to the maximum frequency deviation from the carrier of the signal being tested. Two ranges are provided to indicate deviations of 0 to 50 kHz and 0 to 500 kHz in either direction from the carrier.

TUNE MODE

In the tune mode, the B006 Meter Board takes the FM Discriminator output signal (which is proportional to the difference between the external signal carrier and the instrument front-panel frequency), and amplifies this signal such that a difference of 500 kHz will produce a full-scale deflection on the METER. A difference of less than 500 kHz will produce a proportionally smaller deflection, and a difference of zero will null the METER.

UNLEVELED INDICATOR

A light-emitting diode is mounted on this assembly, and appears through the instrument front panel. Refer to the Output Amplifier module description for an explanation of the circuit driving this lamp.

3.10 C316-7 MODULATION BOARD

This assembly provides the modulating signals used in the AM and FM modes. The front-panel ACCURACY lamps and associated circuitry are also on this assembly (see Figure 3-21).

MODULATING SIGNALS

The AM and FM modes are achieved by simply routing essentially the same signal to the appropriate circuitry by means of the MODULATION MODE switch.

The MODULATION FREQ switch selects one of four sources of modulating frequency, one external and three internal. The internal signal can be selected from one of two CW oscillators or a manually variable DC control.

The two internal oscillators are amplified/leveled by the same circuit for simplicity, but separately energized by the MODULATION FREQ switch. The oscillators are twin T; one is at 400 Hz, the other is at 1 kHz.

ACCURACY LAMPS

Which LED is lit is determined by the CAL switch on the FREQUENCY VERNIER. If any of the phase-locked loops unlock, the energized LED is made to flash by a flasher circuit activated by a DC level from any of the phase-locked loops in the instrument.

3.11 M30-9 CRYSTAL REFERENCE

All the reference frequencies for the phase-locked loops are derived from a single 40 MHz crystal source by means of appropriate multiplication or division.

The reference frequencies supplied are shown in Figure 3-22. These signals are produced by a 40 MHz crystal oscillator and a series of dividers and multipliers.

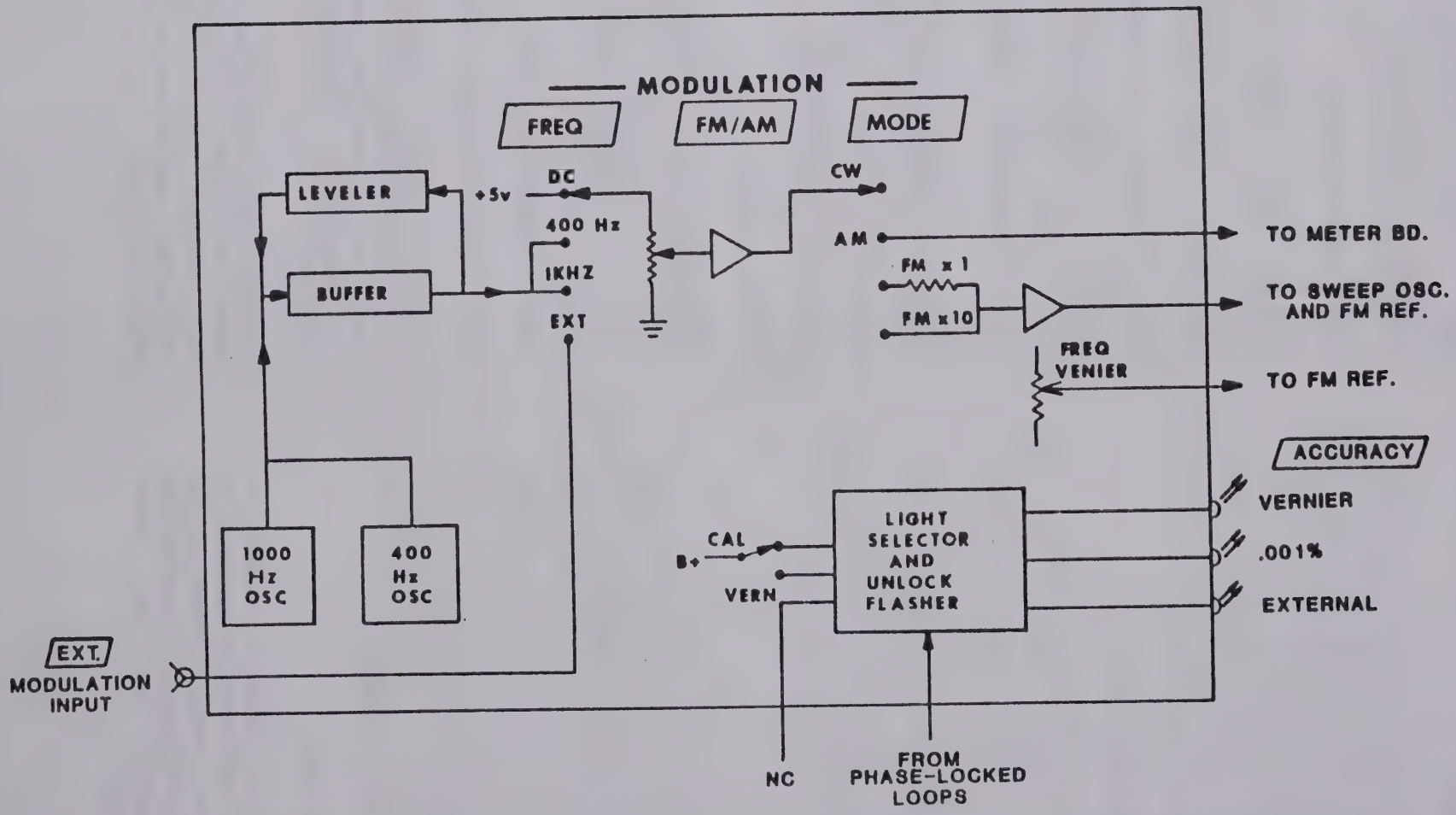


Figure 3-21 C316-7 Modulation Board

The positive output from IC1 also turns on Q2. This effectively grounds pin 7 of timer IC2, which is being operated as an stable oscillator. With pin 7 grounded, the timer is inoperative, and its output, pin 3, is high. The high output from IC2 turns off Q3. This prevents any current flow to the front-panel UNLEVELED light.

If an external RF signal exceeding 6 VRMS is applied to the instrument's RF OUT connector, the output from monitor diode CR1 will go above 5 V. This will produce a negative output from IC1. The positive feedback provided by R7 will latch IC1 in this state. The negative output from IC1 will turn off relay driver Q1. This causes relay K1 to return to its normally open position, removing the external RF signal from the instrument.

The negative output from IC1 also turns off Q2, thus removing the short on pin 7 of timer IC2. This allows the timer to operate as an stable oscillator. The output, pin 3 of IC2, then varies between 0 and 7 volts. This causes Q3, the LED driver, to supply current intermittently to the front-panel UNLEVELED light causing it to flash.

After the RF overload is removed, IC1 can be unlatched by momentarily removing AC power to the instrument.

3.9 B006 METER BOARD

In the output mode, the primary functions of this assembly are to provide the program voltage to the leveler circuit in the Output Amplifier module, and to indicate the RF output level on the instrument front-panel METER. In the tune and deviation measurement modes, the B006 Meter Board serves to process the information coming from the FM Discriminator module and indicate the proper reading on the METER (see Figure 3-20).

NOTE

In tune and deviation measurement, an external meter output is provided, allowing the use of a remote meter with the instrument. This output is in parallel with the instrument front-panel METER, thus, the instrument front-panel METER and the remote meter may be used simultaneously.

METER

In the output mode, the front-panel METER is controlled by the level program from the VERNIER. The METER and its driver circuit are designed to display a reading which corresponds to the actual RF output level from the Output Amplifier module.

In the tune and deviation measurement modes, the level circuitry is switched out, and the METER is driven by the peak detector, providing an indication of either the difference in frequency between the external signal and the instrument front-panel frequency (tune mode), or the maximum FM deviation of the external signal (deviation measurement mode).

MODULATION

The modulating signal from the Modulation Board is applied to the VERNIER which ultimately causes the RF level to change. The level in the Output Amplifier module does not cause the RF level to respond linearity to changes in the level program voltage. To compensate for this, a stage is included to shape the modulation signal before it is applied to the VERNIER.

LEVEL PROGRAM

During CW operation with the instrument in the output mode, the level program is controlled by the front-panel VERNIER control. The output of this control goes to two range calibration circuits, "high" and "low".

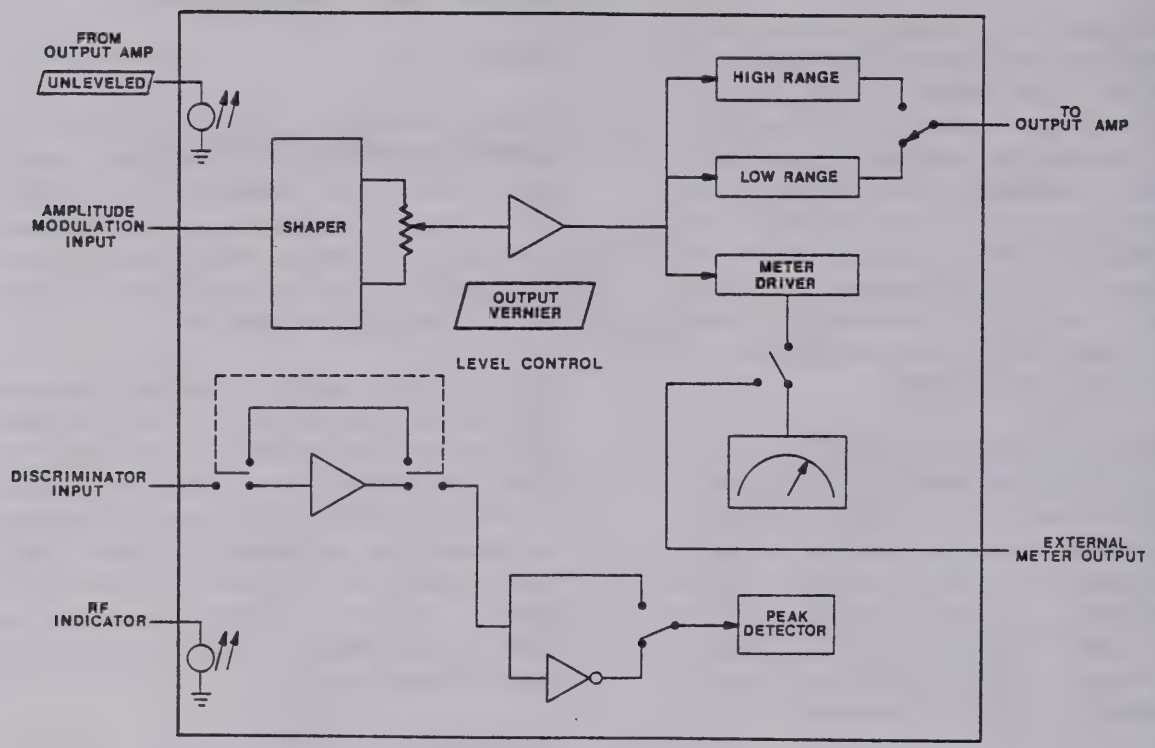


Figure 3-20. B006 Meter Board

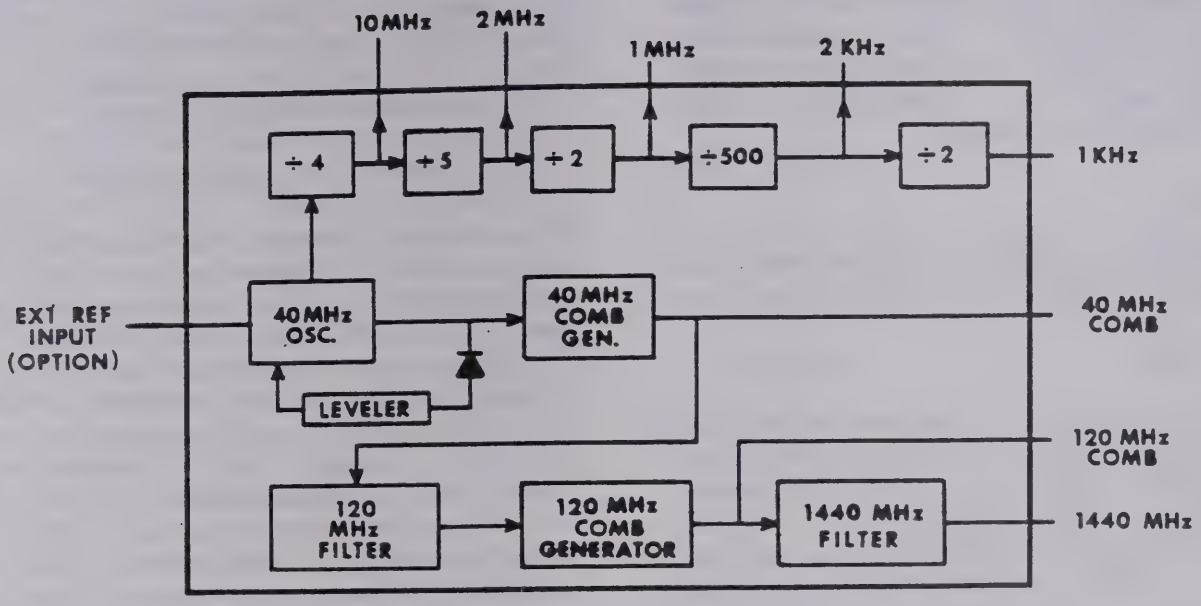


Figure 3-22. M30-9 Crystal Reference

40 MHz OSCILLATOR

The crystal oscillator is the heart of the accuracy of the frequency-determining circuits in the instrument. It is temperature-compensated for frequency stability. The oscillator output is also leveled to provide constant-amplitude signals to the dividers and multipliers.

DIVIDERS

The reference outputs below 40 MHz are produced by a series of TTL counters.

MULTIPLIERS

The 40 MHz oscillator output is fed to a harmonic generator which produces the 40 MHz comb output. From the comb, 120 MHz is selected and applied to another harmonic generator. A sample of the 120 MHz comb output is also fed to a filter which provides the 1440 MHz output.

3.12 TUNE/DEVIATION MEASUREMENT SYSTEM

The tune/deviation measurement system enables the instrument to be tuned to an unknown external frequency, and to measure the FM deviation of an external carrier. In the output mode, the system has effectively no function.

3.12.1 M43 AMPLIFIER/MIXER

The M43 takes the unamplified and unleveled output from the Output Amplifier module, levels it, and mixes it with the leveled and amplified external signal from the front-panel RF IN connector. The difference frequency output from the mixer is then amplified and sent to the FM Discriminator module. The M43 turns on a green LED indicator on the instrument front-panel when the external signal is greater than 10 mVRMS.

In the tune and deviation measurement modes, the Sweep Oscillator output frequency is offset 2 MHz from the carrier of the external signal to be measured, thus producing a difference frequency of 2 MHz which is sent to the FM Discriminator, and is indicated by a null on the instrument front-panel METER in the tune mode.

3.12.2 M44-1 FM DISCRIMINATOR

This module uses a phase-locked loop as an FM Discriminator when the instrument is in the deviation measurement mode. The M44-1 takes the output from the Amplifier/Mixer (a 2 MHz IF signal containing the desired external FM information) and uses it as the reference signal of a phase-locked loop. The variable signal of the loop is the output (approximately 2 MHz) of the FM Reference VCO (which tracks the Amplifier/Mixer output signal to compensate for any external carrier frequency drift). The control voltage of the loop is then the demodulated FM component of the external signal. This control voltage is then amplified and sent to the Meter Board.

At the same time, the M44-1 switches the 2 MHz reference from the Crystal Reference module to the Narrow Oscillator Lock module to keep PLL 3 locked (PLL 5 is inactive in the deviation measurement and tune modes).

In the tune mode, the M44-1 operates in essentially the same manner, except that the IF signal from the Amplifier/Mixer is not 2 MHz (when the external signal is not tuned in), and thus the FM Reference VCO cannot be phase locked to the M44-1 (until the IF is tuned to approximately 2 MHz). The phase-locked loop control voltage thus becomes a measure of the difference between the instrument frequency and the frequency of the external signal being measured.

When the instrument is in the output mode, the M44-1 is inactive, and the RF Reference output is directed through to the Narrow Oscillator lock.

3.12.3 OFFSET BOARD

In the tune and deviation measurement modes, the Offset Board shifts the BCD programming from the Lever/Indicator switches higher by 2 MHz by means of BCD Adders. This causes the Sweep Oscillator output frequency to be offset 2 MHz higher than the FREQUENCY selector indication, and thus a 2 MHz IF is produced when the external input frequency matches the FREQUENCY selector indication.

3.13 DPS2A POWER SUPPLY

The DPS2A Power Supply provides DC power for the rest of the instrument (see Figure 3-23).

TRANSFORMER & FILTERS

The transformer steps down the line voltage to appropriate levels for the three circuits. Full-wave rectifiers and filter capacitors convert this voltage to DC. Both the +18 V and -18 V supplies use protected pass transistors with integral current limiting and thermal protection.

+18 V SUPPLY

The +18 V circuit has a temperature-compensated precision voltage reference. This reference is compared to the output voltage by an error amplifier which corrects any error in the output voltage.

-18 V SUPPLY

The -18 V circuit compares the +18 V and -18 V outputs and holds the difference in their magnitudes to zero.

+7.3 V SUPPLY

The +7.3 V circuit uses a three-terminal adjustable voltage regulator IC to provide a pre-regulated +7.3 V output. This voltage supplies other voltage regulators throughout the instrument.

3.14 50130-01 STEP ATTENUATOR

The 50130-01 Step Attenuator is a combination of five pi-pad sections of 10, 20, 30, 30, and 40 dB. The pads are programmed by cams controlled by the OUTPUT Step Attenuator dial to provide 0 to 130 dB of passive attenuation in 10 dB steps.

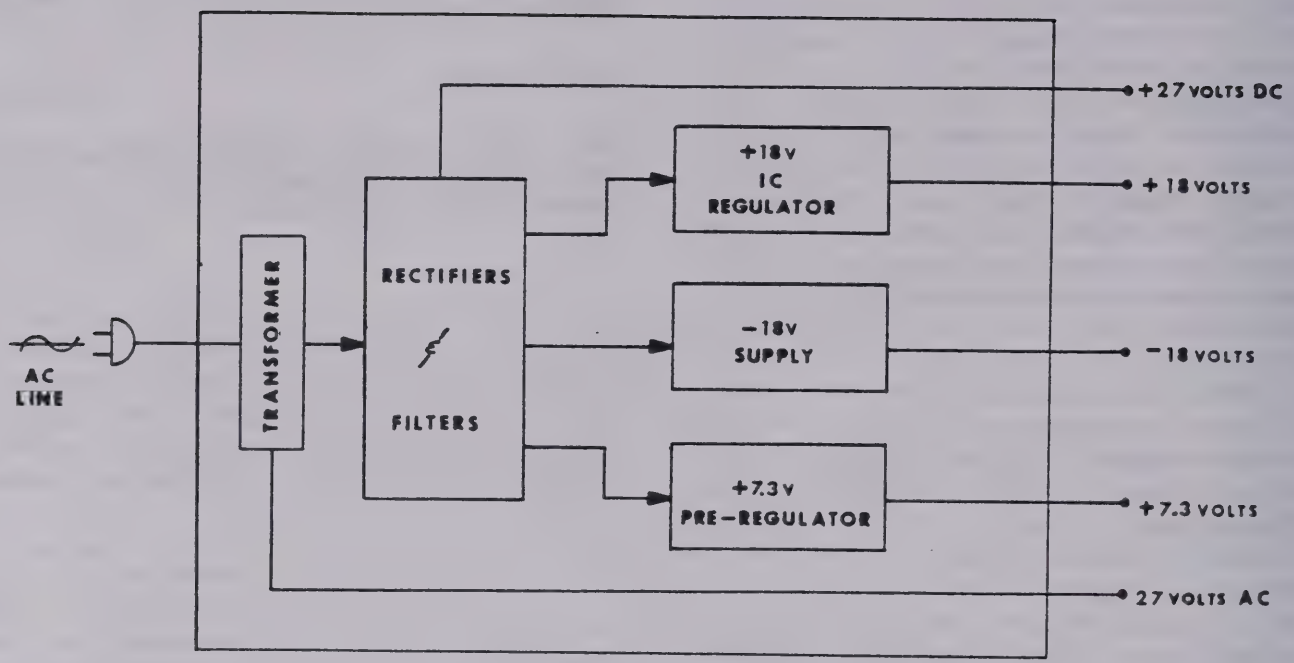


Figure 3-23. DPS2A Power Supply

4.1 INTRODUCTION

The purpose of the performance tests in the following sections is to verify that the Signal Generator meets its published specifications (Section 1.2). Individual performance tests consist of: the specification to be verified; the method of testing; a list of equipment required; and a detailed test procedure including, in some cases, a simplified setup drawing.

Critical specifications for each item of test equipment are listed in Table 4-1. Except as detailed, settings of test equipment apply to performance test procedures. All other test equipment operating details are omitted.

The Signal Generator should have its top and bottom covers installed for the performance tests. All of the tests can be performed without access to the internal controls except 4.22, the RF Protection circuit check. Before applying power to the Signal Generator, see Section 2 for details of electrical installation. The line voltage should be maintained as specified in Section 2.3 throughout the tests. The performance test procedures are begun after a two-hour minimum warmup of the signal generator in a +20 to +30° C ambient temperature range.

A copy of the Performance Test Record (PTR) is provided at the end of this section for convenience in recording the performance of the Signal Generator during performance tests. It can be filled out and used as a permanent record for incoming inspection, or it can be used as a guide for routine performance testing. The PTR lists the section, test, and specification limits. All tests refer to this record

TABLE 4-1. RECOMMENDED TEST EQUIPMENT
FOR PERFORMANCE TESTS

INSTRUMENT	CRITICAL REQUIREMENT	RECOMMENDED
(1) Digital Multimeter	Accuracy: ±0.1%	Keithley 179
(2) Distortion Analyzer	Range: to 100 kHz	HP334A
(3) Frequency Counter	Range: to 520 MHz	HP530B/5303B
(4) Function Generator	Level: 10 Vpp sine wave into 600 ohm load Range: to 100 kHz Distortion: <1%	Wavetek 130
(5) Power Meter	Range: to 520 MHz Input Level: -7 to +13 dBm Accuracy: ±1%FS	HP435A/8481A
(6) Modulation Meter	Range: to 520 MHz Residual FM: <100 Hz (RMS) (quiet room) Residual AM: ±0.1% (RMS) (in CW) AM Accuracy: ±(2%R+1%FS)	Radiometer AFM2
(7) Oscilloscope	Range: DC to 2 MHz Sensitivity: 2 V/div (AC coupled)	Tektronix D10/ 5A18N/5B10N
(8) Spectrum Analyzer	Range: to 1040 MHz Display: 1 dB log and 10 dB log	HP8558A/182T
(9) Precision Attenuator Pads	10, 20, 30, and 40 dB	Weinschel 50-10, 50-20, 50-30, and 50-40
(10) Wideband Amplifier	Range: to 520 MHz Gain: 26 dB Impedance: 50 ohm	HP8447D
(11) Signal Generator	Range: to 520 MHz	Wavetek 3002
(12) VSWR Bridge	Range: 5 to 520 MHz, Impedance: 50 ohm, Directivity: 50 dB	Wiltron 60N50
(13) Coaxial Short	Type N female	HP11511A
(14) Coaxial Termination 50 ohm	Type N male, 1.05 SWR	HP908A
(15) 50 ohm Load	----------	HP11593A
(16) Loop Probe	----------	See Figure 4-5

4.2 FREQUENCY RANGE AND RESOLUTION TEST

SPECIFICATION

MIN FREQ	MAX FREQ	RESOLUTION
1 kHz	520 MHz	1 kHz

METHOD

A frequency counter is used to measure frequency range and resolution. Each digit (a total of 56 settings) will be tested.

EQUIPMENT (3)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	050.000 MHz
MODULATION MODE	CW
MODULATION FREQ	N/A
MODULATION FM/AM	N/A
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Connect the RF OUT connector to the 50 ohm input of the frequency counter. Set the counter resolution to 100 Hz.

3. Step through each frequency setting and verify that the actual counter frequency increase per step is equal to the allowable increase per step ±1 count (see following table).

FREQUENCY SETTINGS	INCREASE/STEP (±1 COUNT)
050.0000-050.0090	1.00 kHz
050.0000-050.0900	10.000 Hz
050.0000-050.9000	100.0 kHz
050.0000-059.0000	1.000 MHz
100.0000-190.0000	10.000 MHz
020.0000-520.0000	100.000 MHz

4. Verify the instrument frequency range by selecting the minimum and maximum specified frequencies and noting the frequency counter readings.

5. If both the resolution (step 3) and range (step 4) are correct, place a check mark on line 1 of the PTR.

4.3 FREQUENCY ACCURACY TEST

SPECIFICATION

All modes (CW, AM, and FM) ±0.001% after 15 minutes

METHOD

A frequency counter is used to measure frequency accuracy. All carrier frequencies are derived from a single crystal-controlled oscillator. The instrument will be tested at one CW frequency to verify that the crystal-controlled oscillator operates within specified limits.

When the FREQ VERNIER is not in CAL, the carrier frequencies are derived from a voltage-controlled oscillator in addition to the crystal-controlled oscillator. Frequency accuracy with the FREQ VERNIER not in CAL will be measured by utilizing DC modulation equal to maximum peak sinusoidal modulation in both FM modes. The FREQ VERNIER range will be tested in CW mode.

EQUIPMENT

(3)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	040.000 MHz
MODULATION MODE	CW
MODULATION FREQ	N/A
MODULATION FM/AM	N/A
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Connect the 50 ohm input of the frequency counter to the RF OUT connector.

3. The counter should read between 39,999.60 and 40,000.40 kHz. Record the counter reading to seven places on line 2 of the PTR.

4. Set the instrument controls as follows:

FREQ VERNIER	0 kHz
Frequency selector	001.000 MHz
MODULATION MODE	FMx1
MODULATION FREQ	DC
MODULATION FM/AM	50 kHz

5. The frequency counter should read between 1039.99 and 1060.01 kHz. Record the counter reading to 6 places on line 3 of the PTR.

6. Set the MODULATION MODE to FMx10.

7. The frequency counter should read between 1489.99 and 1510.01 kHz. Record the counter reading to 6 places on line 4 of the PTR.

8. Set the frequency selector to 002.000 MHz.

9. Set the FREQ VERNIER to +3 kHz, and make a note of the counter reading in Hz.

10. Set the FREQ VERNIER to 0 kHz, and subtract the frequency counter reading in Hz from the reading in step 9. The frequency difference should be between 2500 and 3500 Hz. Record the difference on line 5 of the PTR.

11. Set the FREQ VERNIER to -3 kHz, and subtract the frequency counter reading in Hz from the reading at 0 kHz in step 10. The frequency difference should be as in step 10. Record the difference in Hz on line 6 of the PTR.

4.4 FREQUENCY STABILITY TEST

SPECIFICATION

All modes (CW, AM, and FM) <0.2 ppm/hour.
(500 Hz per 10 min when FREQ VERNIER is not in CAL.)

METHOD

The frequency stability is measured with a frequency counter at the indicated time intervals after a 2 hour minimum warmup.

EQUIPMENT

(3)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	520.000 MHz
MODULATION MODE	CW
MODULATION FREQ	N/A
MODULATION FM/AM	N/A
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Connect the 50 ohm input of the frequency counter to the RF OUT connector.

3. Allow the instrument to warm up for at least 2 hours. After the warm-up, record the frequency counter readings to nine places at 15-minute intervals for a one-hour period. The difference between the maximum and minimum readings in the one-hour period should not exceed 104 Hz. Record the difference between the maximum and minimum readings in Hz on line 7 of the PTR.

4. Set the FREQ VERNIER to 0 kHz, the MODULATION MODE to FMx1, the MODULATION FREQ to DC, and the MODULATION FM/AM slider to 10 kHz.

5. After a one-minute interval, record the frequency counter readings to nine places at five-minute intervals for a ten-minute period. The difference between the maximum and minimum readings in the ten-minute period should not exceed 500 Hz. Record the difference between the maximum and minimum frequency readings in Hz on line 4 of the PTR.

4.5 OUTPUT LEVEL ACCURACY TESTS

SPECIFICATION

Power Level: +13 to -137 dBm (1 VRMS to 0.03 µVRMS)

Attenuator Range: Continuously adjustable in 10 dB steps and an 11 dB VERNIER. Output level is indicated on a front-panel METER calibrated in dBm and volts RMS.

Total Level Accuracy: ±1.25 dB (+13 to -7 dBm), ±1.95 dB (-7 to -77 dBm), ±2.75 dB (-77 to -137 dBm).

Accuracy Breakdown: Flatness; ±0.75 dB (+13 to -7 dBm), Output METER; ±0.5 dB, Step Attenuator; ±0.5 dB to 70 dB (±0.2 dB calibration error), ±1.0 dB to 130 dB (±0.5 dB calibration error).

METHOD

The ±1.25 dB level accuracy between +13 and -7 dBm consists of the sum of the output METER error (±0.5 dB), and the flatness error (±0.75 dB). Both errors are measured with a power meter.

The output METER error is measured at 50 MHz in two 10 dB output ranges (+13 to +3 dBm and +3 to -7 dBm).

The flatness is measured relative to 50 MHz in 10 MHz steps between 10 and 520 MHz at +12, +3, and -7 dBm output levels.

The level accuracy below -7 dBm depends upon the OUTPUT Step Attenuator error in addition to the output METER error and the flatness.

The OUTPUT Step Attenuator is a combination of pi-pad sections of 10, 20, 30, 30, and 40 dB. These five pi-pads are programmed by cams to provide 0 to 130 dB of attenuation in 10 dB steps as shown in the table below.

OUTPUT STEP ATTENUATOR POSITION	ACTIVE STEP ATTENUATOR PADS (X)				
dBm	10 dB	20 dB	30 dB	30 dB	40 dB
+ 10					
0					
- 10	x				
- 20		x			
- 30			x		
- 40	x		x		
- 50		x	x		
- 60			x	x	
- 70	x		x	x	
- 80		x	x	x	
- 90		x		x	x
-100			x	x	x
-110	x		x	x	x
-120		x	x	x	x
-130	x	x	x	x	x

Note that no Step Attenuator pads are active in the +10 dBm and 0 dBm positions. A leveled PIN diode attenuator reduces the output level by 10 dB in all positions of the OUTPUT Step Attenuator below +10 dBm. The output level over the entire range of +13 dBm to -137 dBm including an 11 dB VERNIER is controlled by the PIN leveler system.

The Step Attenuator error is measured by an RF substitution method. Each of the five pads (10, 20, 30, 30, 40 dB) in the Step Attenuator is measured at 520 MHz. The second 30 dB pad and the 40 dB pad are measured in combination with other pads. A reference output level is set with a power meter. A reference trace is obtained with a spectrum analyzer and a standard attenuator pad. The standard pad is removed and the Step Attenuator position to be measured is substituted. The spectrum analyzer trace is returned to the reference level by resetting the output level. The resulting instrument output level is measured and compared to the original power meter reference level. An RF amplifier is required to boost signal levels below the -20 dBm level.

4.5.1 OUTPUT METER ACCURACY TEST

EQUIPMENT (5)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	050.000
MODULATION MODE	CW
MODULATION FREQ	N/A
MODULATION FM/AM	N/A
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Calibrate the power meter and power sensor. Set the power meter to the +15 dBm range. Connect the power sensor to the front-panel RF OUT connector. (When reading the power meter, set the range switch so that the meter indicates between 0 and -5 dBm.)

NOTE: The indicated output level of the instrument is equal to the sum of the output METER reading and the Step Attenuator setting. The difference between the actual power meter reading and the indicated output level is the output METER error. For example, the indicated output level is +13 dBm for an output METER reading of +3 dBm and an OUTPUT Step Attenuator setting of +10 dBm. If the power meter reading is +13.15 dBm, the output METER error is +0.15 dB.

3. Adjust the front-panel OUTPUT VERNIER for a _3 dBm output METER reading. Observe the power meter reading and make a note of the output METER error to the nearest 0.05 dB)1/4 division). Continue to adjust the OUTPUT VERNIER for output METER reading increments of 1 dB between +3 and -7 dBm, and note the output METER error at each reading. As the test progresses, make a note of the maximum output METER error to the nearest 0.05 dB. The allowable error is ±0.50 dB. Record the maximum output METER error on line 9 of the PTR.

Set the instrument OUTPUT Step Attenuator to 0 dBm and repeat step 3 above. Record the maximum output METER error on line 10 of the PTR.

4.5.2 FLATNESS TEST

EQUIPMENT

(5)

PROCEDURE

1. Set the instrument controls as in Section 4.5.1.

2. Set the power meter to the +15 dBm range. Connect the power sensor to the front-panel RF OUT connector. Set the output VERNIER for a +12 dBm power meter reading.

3. Change the instrument RF output frequency in 10 MHz steps between 10 and 520 MHz and observe the maximum change in the power meter readings from the +12 dBm reading. The allowable error is ±0.75 dB. Record the maximum change on line 11 of the PTR.

4. Select a frequency of 050.000 MHz and set the output VERNIER for a +3 dBm power meter reading.

5. Repeat step 3 except observe the maximum change in the power meter readings from the +3 dBm reading. Record the maximum change from the +3 dBm reading on line 12 of the PTR.

6. Set the output VERNIER for a -7 dBm power meter reading.

7. Repeat step 3 except observe the maximum change in the power meter readings from the -7 dBm reading. Record the maximum change from the -7 dBm reading on line 13 of the PTR.

4.5.3 STEP ATTENUATOR ACCURACY TEST

EQUIPMENT

(5) (8) (9) (10)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	520.000
MODULATION MODE	AM
MODULATION FREQ	DC
MODULATION FM/AM	0% AM
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	0 dBm

2. Set the power meter to the +10 dBm range. Connect the power sensor to the RF OUT connector.

3. Adjust the MODULATION FM/AM slider for a +7 dBm power meter reading. (Output METER will read off scale.)

4. Disconnect the power sensor and connect a standard 10 dB attenuator pad to the RF OUT connector. Connect the output of the attenuator pad to the spectrum analyzer as shown in Figure 4-1.

5. Set the spectrum analyzer to 520 MHz, the bandwidth to 10 kHz, and the frequency span per division to 3 kHz. Set the video filter to 100 Hz and the vertical display to 1 dB per division.

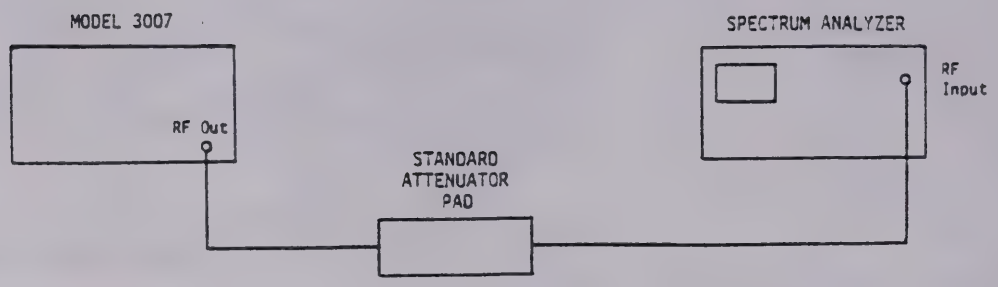


Figure 4-1. Test Set-up

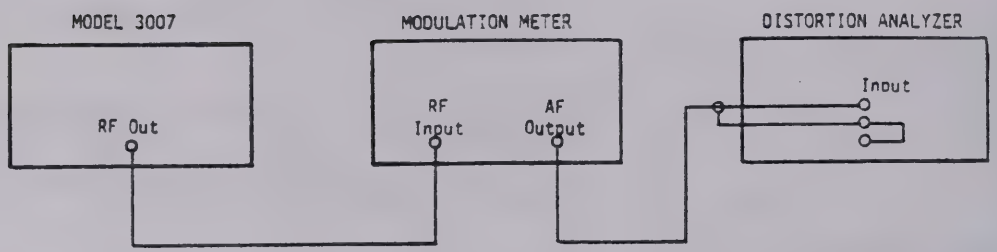


Figure 4-2. Test Set-up

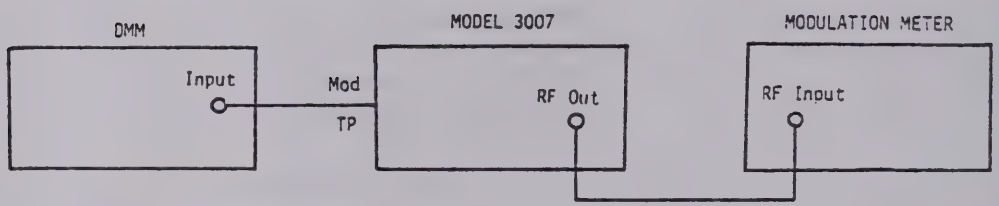


Figure 4-3. Test Set-up

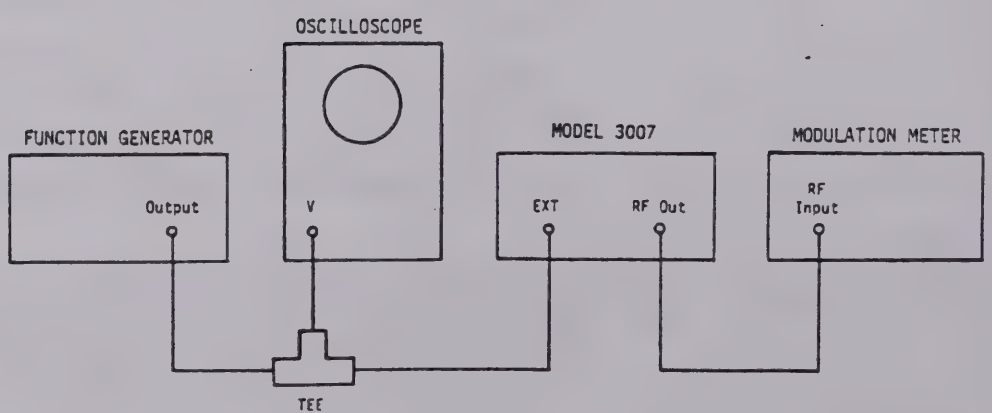


Figure 4-4. Test Set-up

6. Use the analyzer log reference controls to obtain a peak trace one division below the log reference line of the spectrum analyzer display. Center the trace in the display with fine tuning.

7. Set the OUTPUT Step Attenuator to -10 dBm.

8. Disconnect the 10 dB attenuator pad from the setup and reconnect the spectrum analyzer to the RF OUT connector.

9. Use the MODULATION FM/AM control to realign the peak of the trace one division below the log reference line as in step 6.

10. Disconnect the spectrum analyzer from the RF OUT connector. Connect the power meter and set the OUTPUT Step Attenuator to 0 dBm.

11. Observe the difference between the actual power meter reading and the 0 dBm reference setting in step 3. The difference or error should be ±0.7 dB maximum. Record the error on line 14 of the PTR.

12. Repeat steps 3 through 11 using the standard attenuator pads and the instrument output amplitude settings indicated in the following table.

STEP 4 AND 8 ATTENUATOR PAD (dB)	STEP 7 OUTPUT AMPLITUDE (dBm)	STEP 11 RECORD ERROR ON LINE OF PTR
20	-20	15
30	-30	16
60	-60	17
90	-90	18

NOTE: To test the Step Attenuator below -20 dBm, an RF amplifier (>20 dB gain) is required. Insert the amplifier between the standard attenuator pad and the spectrum analyzer. The allowable error for the -90 dBm setting is ±1.5 dB. The Step Attenuator can be tested down to -130 dBm if a higher-gain RF amplifier is used and if precautions are taken to properly shield the RF output from the instrument.

The test may be repeated at other frequencies if desired.

4.6 HARMONICS TEST

SPECIFICATION

<-30 dBc from 1 kHz to 1 MHz
<-26 dBc from 1 to 10 MHz
<-30 dBc from 10 to 520 MHz

METHOD

A spectrum analyzer is used to measure harmonics in the frequency range of the instrument at +13 and +3 dBm output levels.

NOTE: Use the analyzer reference level control to maintain a constant reference level as the instrument frequency is changed.

EQUIPMENT

(8)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	001.000 MHz
MODULATION MODE	CW
MODULATION FREQ	N/A
MODULATION FM/AM	N/A
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Connect the spectrum analyzer to the instrument RF OUT connector.

3. Set the spectrum analyzer to measure harmonic distortion for fundamental frequencies between 1 and 10 MHz. Set the display to 10 dB/division. Locate the zero reference at the left edge of the graticule and adjust the fundamental amplitude to the log reference line (0 dB) in the display.

4. Increase the RF output frequency in 1 MHz steps up to 10 MHz. Record the maximum harmonic level observed (should be <-26 dBc) on line 19 of the PTR.

5. Set the OUTPUT Step Attenuator to 0 dBm and repeat steps 3 and 4. Record the maximum harmonic level observed (should be <-26 dBc) on line 20 of the PTR.

6. Set the frequency selector to 10 MHz and the OUTPUT Step Attenuator to +10 dBm.

7. Set the spectrum analyzer to measure harmonic distortion for fundamental frequencies between 10 and 520 MHz.

8. Increase the RF output frequency in 10 MHz steps between 10 and 520 MHz while observing the spectrum analyzer display. Note the maximum harmonic level observed.

9. Set the spectrum analyzer to measure harmonic distortion for fundamental frequencies below 1 MHz.

10. Set the frequency selector to 000.001 MHz and increase the RF output frequency in 10 kHz steps between 1 kHz and 1 MHz. Record the maximum harmonic level observed in steps 8 and 10 (should be <-30 dBc) on line 21 of the PTR.

11. Set the OUTPUT Step Attenuator to 0 dBm and repeat steps 7 through 10. Record the maximum harmonic level observed (should be <-30 dBc) on line 22 of the PTR.

4.7 NON-HARMONIC TEST

SPECIFICATION

Fundamental Range (MHz)	Non-harmonic Range (MHz)	Non-harmonic Level (dBc)
below 3	below 3	<-60
3 to 250	3 to 250	<-65
3 to 350	3 to 350	<-55
3 to 520	3 to 1000	<-35

METHOD

A spectrum analyzer is used to measure the level of nonharmonics in the frequency range of the instrument at the maximum specified output level of +13 dBm.

EQUIPMENT

(8)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	001.000 MHz
MODULATION MODE	CW
MODULATION FREQ	N/A
MODULATION FM/AM	N/A
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Connect the RF OUT connector to the RF input of the spectrum analyzer.

3. Set the spectrum analyzer to measure the non-harmonic content of the instrument output below 3 MHz. Set the bandwidth to 30 kHz, the frequency span per division to 1 MHz, and the display to 10 dB/division. Locate the zero reference at the left edge of the graticule, and adjust the fundamental to the log reference line (0 dB) in the display.

4. Increase the RF output frequency in 0.1 MHz steps up to 3 MHz. Record the maximum non-harmonic observed (should be <-60 dBc) on line 23 of the PTR.

5. Set the spectrum analyzer to measure the non-harmonic content of the instrument output between 3 and 1000 MHz. Set the bandwidth to 300 kHz and the frequency span per division to 100 MHz.

6. Increase the RF output frequency in 1 MHz steps between 3 and 10 MHz, and in 10 MHz steps between 10 and 500 MHz while observing the spectrum analyzer display. Using the table below, record the maximum nonharmonic level observed in each range on the applicable line of the PTR.

FUNDAMENTAL RANGE (MHz)	NON-HARMONIC RANGE (MHz)	NON-HARMONIC LEVEL (dBc)	PTR LINE NUMBER
3-250	3-250	<-65	24
3-350	3-350	<-55	25
3-520	3-1000	<-35	26

4.8 RESIDUAL AM TEST

SPECIFICATION

<-65 dBc in a 50 Hz to 15 kHz post-detection bandwidth.

METHOD

A modulation meter operating in AM mode is used to demodulate the instrument output at the minimum leveler point where AM noise is maximum. A distortion analyzer (operating in level mode) is used to increase the resolution of the demodulated output of the modulation meter. The system is calibrated at a 10% AM level. The 10% AM is removed and the residual AM is read in dB below the calibrated 10% AM level. 20 dB is added to the reading to relate the residual AM to the carrier.

EQUIPMENT

(2) (6)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	500.000 MHz
MODULATION MODE	AM
MODULATION FREQ	1 kHz
MODULATION FM/AM	0% AM
OUTPUT VERNIER	-7 dB
OUTPUT Step Attenuator	0 dBm

2. Connect the equipment as shown in Figure 4-2.

3. Set the modulation meter to read %AM at 500 MHz. Set the RF input attenuation to 10 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +AM, the range switch to 10, and the filter bandwidth to 50 Hz - 15 kHz.

4. Use the MODULATION FM/AM control to produce a modulation meter reading of 10% AM.

NOTE: 10% AM is obtained at a full-scale reading of 100 with the modulation meter range switch set to 10.

5. With the distortion analyzer operating in level mode, calibrate it for a 0 dB meter reading. The system is now calibrated at a reference level of -20 dBc. Since the modulating signal and carrier amplitudes are equal at 100% AM, it follows that at 10% AM the modulating signal is -20 dBc.

6. Set the MODULATION MODE to CW.

7. Without disturbing the instrument or modulation meter controls, set the distortion analyzer to read residual AM. Set the range switch so that the meter reads between 0 and -10 dB. First, read the residual AM below the 0 dB reference level in step 5, then add 20 dB to the above reading to obtain the residual AM below the carrier. (For example, a 48 dB residual AM below the 0 dB reference +20 dB = 68 dB residual AM below the carrier.) The residual AM should be <-65 dBc. Record the residual AM in dBc on line 27 of the PTR.

Other frequencies may be tested as desired.

4.9 RESIDUAL FM TEST

SPECIFICATION

<100 Hz in a 300 Hz to 3 kHz post-detection bandwidth
<200 Hz in a 50 Hz to 15 kHz post-detection bandwidth

METHOD

A modulation meter is used to measure residual FM. The test is performed at maximum frequency and output level. The instrument is operated in FM mode where the residual FM is greatest.

The residual FM is measured in an environment where the noise level is <60 dB relative to 2×10^{-4} µbar.

EQUIPMENT

(6)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	520.000 MHz
MODULATION MODE	FMx10
MODULATION FREQ	EXT
MODULATION FM/AM	0 kHz
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Connect the front-panel RF OUT connector to the 50 ohm RF input of the modulation meter.

3. Set the modulation meter to read FM deviation at 520 MHz. Set the range switch to 3, the RF input attenuation to 20 dB, the IF bandwidth to ±400 kHz, the meter response to fast, and the filter bandwidth to 50 Hz - 15 kHz.

4. Measure the average level of the FM deviation on the modulation meter (disregard occasional peaks). The residual FM should be <200 Hz. Read the residual FM on the modulation meter with the function switch set to +FM and the -FM positions. Record the greater of the two readings in Hz on line 28 of the PTR.

4.10 INTERNAL MODULATION FREQUENCY ACCURACY TEST

SPECIFICATION

400 Hz and 1 kHz ±5%

METHOD

A frequency counter is used to measure modulation frequency at the instrument MOD TP. Since the same oscillators are used for both the AM and FM modes, one test will suffice for both modes.

EQUIPMENT

(3)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	N/A
Frequency selector	N/A
MODULATION MODE	N/A
MODULATION FREQ	400 Hz
MODULATION FM/AM	Mid-range
OUTPUT VERNIER	N/A
OUTPUT Step Attenuator	N/A

2. Connect the low frequency input of the frequency counter to the MOD TP and the cable shield to ground (rear-panel PROGRAMMING jack pins 36 and 25, respectively).

3. The counter should read between 380 and 420 Hz. Record the counter reading on line 29 of the PTR.

4. Set the MODULATION FREQ control to 1 kHz.

5. The counter should read between 950 and 1050 Hz. Record the counter reading on line 30 of the PTR.

4.11 PERCENT AM ACCURACY TEST

SPECIFICATION

±8% at a frequency of 1 kHz. NOTE: This specification applies at an output of ≤+3 dBm. AM is possible above +3 dBm if the peak of the modulated output does not exceed +13 dBm.

METHOD

The %AM accuracy is measured with a modulation meter after the front-panel MODULATION FM/AM control error, which is ±4%, is subtracted out. The FM/AM control accuracy, which consists of the control linearity and the modulation scale errors, is measured in terms of the DC voltage at the rear-panel MOD TP. The calibration of the voltage across the control at maximum position is checked initially.

The remaining %AM accuracy, which is ±4%, is measured by the modulation meter with accurately measured voltage applied to the instrument modulation system. The measurement uncertainty is 2% of the reading + 1% of full scale.

EQUIPMENT

(1) (6)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	520.000 MHz
MODULATION MODE	CW
MODULATION FREQ	DC
MODULATION FM/AM	0% AM
OUTPUT VERNIER	-3 dB
OUTPUT Step Attenuator	0 dBm

2. Connect the equipment as shown in Figure 4-3. Connect the center conductor of the cable between the high terminal of the digital multimeter and the MOD TP (pin 36 of rear-panel PROGRAMMING jack J101). Connect the cable shield between the low terminal of the digital multimeter and the instrument ground (pin 25 of J101).

3. Set the MODULATION FM/AM control to its full up position.

4. The digital multimeter should read 5.000 ±0.020 VDC. If the voltage is within limits, continue to step 5. If not, recalibrate (Section 5.3.9).

5. Set the MODULATION FM/AM control to 30% AM.

6. The digital multimeter should read between 1.300 and 1.700 VDC. Record the reading on line 31 of the PTR.

7. Set the MODULATION FM/AM control to 90% AM.

8. The digital multimeter should read between 4.300 and 4.700 VDC. Record the reading on line 32 of the PTR. NOTE: This concludes the MODULATION FM/AM control accuracy test. As many other points may be tested as desired.

9. Adjust the MODULATION FM/AM control to 0% AM.

10. Set the modulation meter to read %AM at 520 MHz. Set the meter range switch to 100, the RF input attenuation to 10 dB, the IF bandwidth to ±400 Hz, the meter response to fast, the function switch to +AM, and the filter bandwidth to 50 Hz - 15 kHz.

11. Adjust the MODULATION FM/AM control for a reading of 1.500 ±0.003 VDC on the digital multimeter. Set the MODULATION FREQ switch to 1 kHz and the MODULATION MODE switch to AM.

12. Make a note of the modulation meter reading in %AM. Set the modulation meter function switch to -AM, and note the modulation meter %AM reading as before. Compute the average of the two readings. The average %AM should be between 26 and 34. Record the average %AM to the nearest 0.5% on line 33 of the PTR.

13. Set the MODULATION MODE switch to CW and the MODULATION FREQ switch to DC.

14. Adjust the MODULATION FM/AM control for a reading of 4.500 ±0.003 VDC on the digital multimeter. Set the MODULATION FREQ switch to 1 kHz and the MODULATION MODE switch to AM.

15. Make a note of the modulation meter reading in %AM. Set the modulation function switch to +AM and note the modulation meter %AM reading as before. Compute the average of the two readings. The average %AM should be between 86 and 94 AM. Record the average %AM to the nearest 0.5% on line 34 of the PTR.

As many other points may be tested as desired.

4.12 AM BANDWIDTH TEST

SPECIFICATION

DC to 20 kHz (3 dB bandwidth)
Input level required for calibrated control: 10 Vpp into 600 ohms

METHOD

The measurement is made with a modulation meter operating in AM mode and a function generator. The function generator supplies an external sine wave to amplitude modulate the instrument. The system is calibrated at -6 dB on the modulation meter dB scale (approximately 50% AM). The external modulation frequency is increased from 1 kHz to 20 kHz and the AM bandwidth is measured as the change in dB level from the calibration level.

EQUIPMENT

(4) (6) (7)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	050.000 MHz
MODULATION MODE	AM
MODULATION FREQ	EXT
MODULATION FM/AM	0% AM
OUTPUT VERNIER	+3 dB
OUTPUT Step Attenuator	0 dBm

2. Connect the equipment as shown in Figure 4-4.

3. Set the modulation meter to read %AM at 50 MHz. Set the RF input attenuation to 20 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +AM, the range switch to 100% and the filter bandwidth to 200 kHz.

4. Set the function generator for a 1 kHz sine wave output and the attenuator controls for a 10 Vpp sine wave on the oscilloscope.

5. Use the MODULATION FM/AM slider to produce a modulation meter reading of -6 dB (approximately 50% AM).

6. Maintain the 10 Vpp output level and increase the function generator frequency from 1 to 20 kHz. Observe the modulation meter scale. It should read between -3 and -9 dB. Note the change in dB from the -6 dB calibration level.

7. Repeat steps 4 through 6 with the modulation meter function switch set to -AM. Note the change in dB from the -6 dB calibration level.

8. Record the larger of the two dB changes obtained in steps 6 and 7 of line 35 of the PTR.

4.13 AM DISTORTION TEST

SPECIFICATION

<3% distortion to 70% AM; <5% to 90% AM (at a frequency of 1 kHz).

NOTE: This specification applies for an output level of ≤+3 dBm. AM is possible above +3 dBm if the peak of the modulated output does not exceed +13 dBm.

METHOD

The measurement is made with a modulation meter and a distortion analyzer which measures the distortion of the demodulated AM from the modulation meter. The measurement is made at the minimum leveler point where the AM distortion is normally greatest.

EQUIPMENT

(2) (6)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	520.000 MHz
MODULATION MODE	AM
MODULATION FREQ	1 kHz
MODULATION FM/AM	0% AM
OUTPUT VERNIER	-7 dB
OUTPUT Step Attenuator	0 dBm

2. Connect the equipment as shown in Figure 4-2.

3. Set the modulation meter to read %AM at 520 MHz. Set the RF input attenuation to 10 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +AM, the range switch to 100% and the filter bandwidth to 50 Hz to 15 kHz.

4. Set the MODULATION FM/AM slider for a modulation depth of 70% AM. Set the modulation meter function switch to -AM, and observe the modulation meter reading. Readjust the MODULATION FM/AM slider until the average of the modulation meter readings in the +AM and -AM positions of the function switch is equal to 70% AM.

5. Calibrate the distortion analyzer and measure the distortion. The distortion should be less than 3%. Record the distortion on line 36 of the PTR.

6. Set the MODULATION FM/AM slider for a modulation depth of 90% AM. Readjust the MODULATION FM/AM slider until the average of the modulation meter readings in the +AM and -AM positions of the function switch is equal to 90% AM.

7. Calibrate the distortion analyzer and measure the distortion. The distortion should be less than 5%. Record the distortion on line 37 of the PTR.

4.14 FM DEVIATION ACCURACY TEST

SPECIFICATION

±2.5 kHz on FMx1 range; ±25 kHz on FMx10 range

METHOD

The deviation is measured in both FM modes using an internal DC voltage equal to the peak of the internal sine wave voltages. A frequency counter is used to measure the maximum deviation in both FM modes.

EQUIPMENT

(3)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	0 kHz
Frequency selector	050.000 MHz
MODULATION MODE	FMx1
MODULATION FREQ	DC
MODULATION FM/AM	50 kHz on FM scale
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Connect the 50 ohm input of the frequency counter to the RF OUT connector.

3. Read the frequency counter and record the reading to 8 places on line 38 of the PTR.

4. Adjust the MODULATION FM/AM control to 0 kHz deviation on the FM scale.

5. Read the frequency counter and record the reading to 8 places on line 39 of the PTR.

6. Subtract the reading obtained in Step 5 from the reading obtained in Step 3. The difference between the two readings should be between 47.500 and 52.500 kHz. Record the difference in kHz on line 40 of the PTR.

7. Set the instrument MODULATION MODE to FMx10 and adjust the MODULATION FM/AM control to 500 kHz deviation on the FM scale.

8. Read the frequency counter and record the reading to 6 places on line 41 of the PTR.

9. Adjust the instrument MODULATION FM/AM control to 0 kHz deviation on the FM scale.

10. Read the frequency counter and record the reading to 6 places on line 42 of the PTR.

11. Subtract the reading obtained in Step 10 from the reading obtained in Step 8. The difference between the two readings should be between 475.0 and 525.0 kHz. Record the difference in kHz on line 43 of the PTR.

4.15 FM BANDWIDTH TEST

SPECIFICATION

External: 50 Hz to 100 kHz (3 dB bandwidth) with FREQ VERNIER in CAL.
DC to 100 kHz (3 dB bandwidth) with FREQ VERNIER not in CAL.
Input level required for calibrated control: 1.0 Vpp into 600 ohms.

METHOD

The measurement is made with a modulation meter and a function generator. The function generator supplies an external sine wave to frequency modulate the output signal. The system is calibrated with a 1 kHz external sine wave at an indicated deviation 1 dB below the 0 dB reference on the modulation meter dB scale (approximately 90 kHz deviation). The external modulation frequency is varied from 1 kHz to 500 Hz, and from 1 kHz to 100 kHz, and the FM bandwidth is measured as the change in dB level from the calibrated level.

EQUIPMENT

(4) (6) (7)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	520.000 MHz
MODULATION MODE	FMx10
MODULATION FREQ	EXT
MODULATION FM/AM 0 kHz	
OUTPUT VERNIER	+3 dB
OUTPUT Step Attenuator	+10 dBm

2. Connect the equipment as shown in Figure 4-4.

3. Set the modulation meter to read FM deviation at 520 MHz. Set the RF input attenuation to 20 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +FM, the meter range switch to 300 kHz, and the filter bandwidth to 200 kHz.

4. Set the function generator for a 1 kHz sine wave output and the attenuator controls for a 10 Vpp sine wave on the oscilloscope.

5. Use the MODULATION FM/AM slider to produce a modulation meter reading of -1 dB (approximately 90 kHz deviation).

6. Maintain the 10 Vpp external input level during this step. Slowly decrease the function generator frequency from 1 kHz to 500 Hz, and slowly increase the frequency to 100 kHz while observing the modulation meter. It should read between +2 and -4 dB. Note the maximum change from the -1 dB reference to the nearest 0.25 dB.

7. Repeat steps 4 through 6 with the modulation meter function switch set to -FM. Note the change from the -1 dB reference as in step 6. Record the larger of the two changes in dB (in this step and in step 6) on line 44 of the PTR.

4.16 FM DISTORTION TEST

SPECIFICATION

4% (3 to 100 kHz deviation) at a frequency of 1 kHz.

METHOD

The measurement is made with a modulation meter and a distortion analyzer, which measures the distortion of the demodulated FM from the modulation meter. Distortion below 3 kHz deviation increases because of residual FM noise. The distortion at 3 kHz deviation is measured in an environment where the noise level is <60 dB relative to 2×10^{-4} µbar.

EQUIPMENT

(2) (6)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	520.000 MHz
MODULATION MODE	FMx1
MODULATION FREQ	1 kHz
MODULATION FM/AM	3 kHz
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

2. Connect the equipment as shown in Figure 4-2.

3. Set the modulation meter to read FM deviation at 520 MHz. Set the RF input attenuation to 20 dB, the IF bandwidth to ±400 kHz, the meter response to fast, the function switch to +FM, the meter range switch to 10 kHz, and the filter bandwidth to 50 Hz - 15 kHz. The modulation meter should read approximately 3 kHz.

4. Calibrate the distortion analyzer and measure distortion. The distortion should be less than 4%.

5. Repeat steps 3 and 4 for FM deviations up to 10 kHz. The distortion at all points should be less than 4%. Record the worst-case distortion on line 45 of the PTR.

6. Set the modulation meter range switch to 100 kHz and the filter to 75 kHz. Repeat steps 3 and 4 for FM deviations of between 10 and 100 kHz. The distortion at all points should be less than 4%. Record the worst-case distortion on line 46 of the PTR.

4.17 IMPEDANCE TEST

SPECIFICATION

50 ohm; VSWR <1.3 at RF output levels <0.1 VRMS.

METHOD

The measurement is made with a VSWR bridge, and the return loss is displayed on a spectrum analyzer. An RF signal from a signal generator is fed to the input of the bridge. A reference level is established by shorting the bridge output port. The short is replaced by the RF impedance of the instrument. The signal generator is tuned from 1 kHz to 520 MHz, and the return loss versus frequency is displayed.

EQUIPMENT

(8) (11) (12) (13)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	520.000 MHz
MODULATION MODE	CW
MODULATION FREQ	N/A
MODULATION FM/AM	N/A
OUTPUT VERNIER	+3 dB
OUTPUT Step Attenuator	-10 dBm

2. Connect the equipment as shown in Figure 4-5. Connect the signal generator to the input port, the spectrum analyzer to the reflected output port, and the coaxial short to the device-under-test port of the VSWR bridge.

3. Set the signal generator output level to -10 dBm, the mode to CW and the frequency to 250 MHz.

4. Set the spectrum analyzer to span 0 to 500 MHz and the bandwidth to 300 kHz. Use the log reference level controls to calibrate the 250 MHz signal at the top line (0 dB reference) of the display graticule.

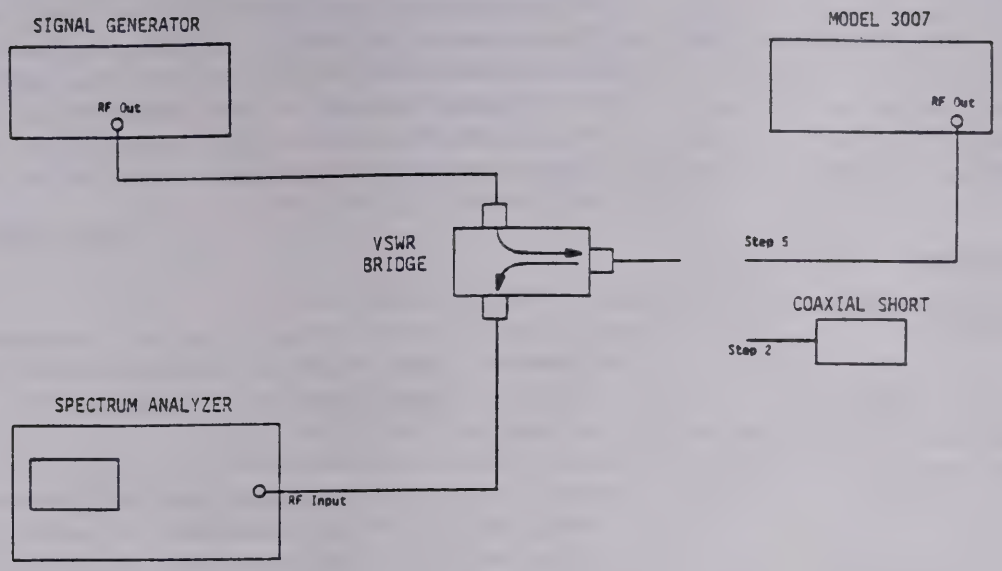
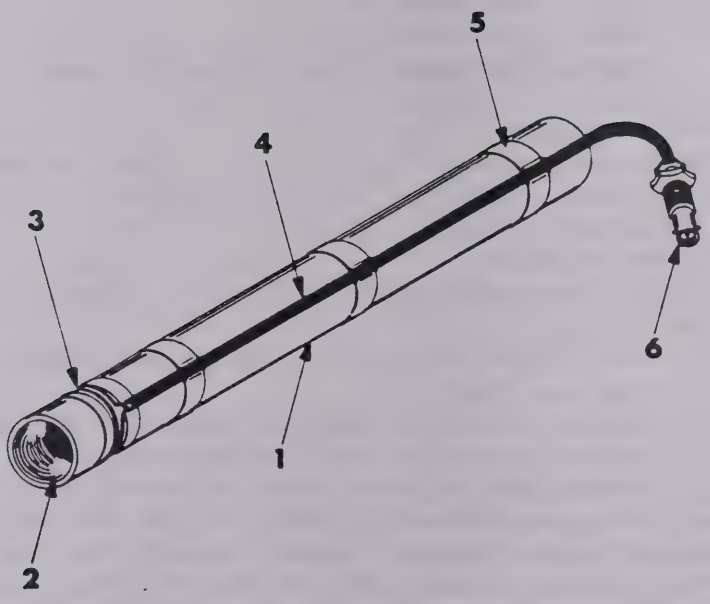


Figure 4-5. Test Set-up



1. Rexolite Rod: 1.25 in. dia. by 11 in.
2. Hole: 1.00 in dia. by 0.80 in. deep.
3. Groove: 0.120 in wide by 0.125 in deep 1.00 in from end of rod.
4. Coaxial Cable: (RG-174/U) 0.110" diameter by 19" long. Strip shield for 7 in, and cut off shield to ½ in length. Strip insulation from center conductor ½ in. Wind 2 turns of insulated center conductor in groove of rod. Solder shield to center conductor, and insulate the solder joint.
5. Wind mylar tape around the two-turn loop, and around the rod (three places).
6. BNC male connector.

Figure 4-6. Loop Probe

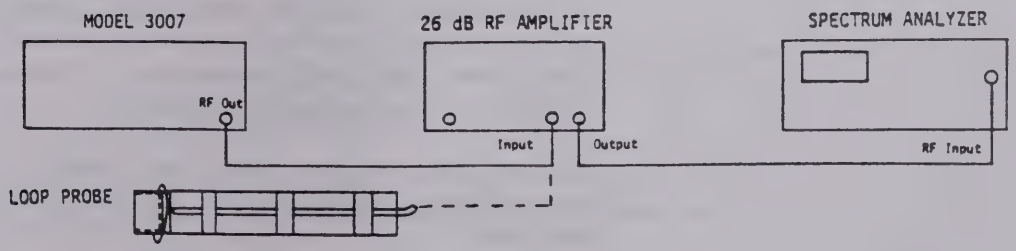


Figure 4-7. Test Set-up

5. Disconnect the coaxial short and connect the device-under-test port of the VSWR bridge to the front-panel RF OUT connector. Tune the signal generator from 1 kHz to 520 MHz and verify that the signal level in the display is >19 dB below the 0 dB reference. Disregard the signal at 520 MHz. Record the reading in dB below the reference on line 47 of the PTR.

4.18 RFI TEST

SPECIFICATION

<1.0 µV is induced in a two-turn, one-inch diameter loop which is held one inch away from any surface (loop feeds a 50 ohm receiver).

METHOD

A 50 ohm receiver consisting of a 26 dB amplifier and a spectrum analyzer are calibrated at a 1 µV level using the instrument. A loop probe is then connected to the receiver and the leakage is measured at a one-inch distance from the external surfaces of the instrument with the RF OUT connector terminated in 50 ohms. A screen room may be required for this measurement.

EQUIPMENT

(8) (10) (14) (15) (16)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	500.000 MHz
MODULATION MODE	CW
MODULATION FREQ	N/A
OUTPUT VERNIER	+3 dB
OUTPUT Step Attenuator	-110 dBm

2. Connect the equipment as shown in Figure 4-7.

3. Set the spectrum analyzer bandwidth to 100 kHz, the scan width to 0.5 MHz/division, the video filter to 100 Hz, the input attenuation to 0 dB, and the log reference level to -50 dBm with a 10 dB/division vertical scale. Center the signal in the display using the center frequency control. Calibrate the analyzer for the -107 dBm signal at the -31 dBm graticule using the log reference controls.

4. Disconnect the RF amplifier from the instrument and connect the 50 ohm coaxial termination to the instrument RF OUT connector. Tighten the termination to minimize RF leakage.

5. Set the OUTPUT Step Attenuator to -10 dBm and the OUTPUT VERNIER for a +3 dB output METER reading.

6. Connect the loop probe to the input of the RF amplifier. Move the loop probe over the surfaces of the instrument with the two-turn loop at a one-inch distance. The signal plus noise should be less than the -107 dBm reference. Record the maximum reading in dBm on line 48 of the PTR.

4.19 INPUT LEVEL TEST

SPECIFICATION

An external RF signal in the range of 10 mVRMS to 5 VRMS lights the RF IN lamp.

METHOD

A CW signal in the range of 10 mVRMS to 5 VRMS is applied to the RF IN connector in the deviation mode to verify that the green RF IN lamp lights.

EQUIPMENT

(11)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	N/A
MODULATION MODE	CW
MODULATION FREQ	EXT
MODULATION FM/AM	0
OUTPUT VERNIER	N/A
OUTPUT Step Attenuator	N/A
METER FUNCTION	DEVIATION, TUNE

2. Connect the output of the signal generator to the RF IN connector.

3. Set the signal generator controls for a 30 MHz, CW, -27 dBm (10 mVRMS) output.

4. The green RF IN lamp should light.

5. Increase the frequency selector setting of the signal generator in 10 MHz steps between 30 and 500 MHz and verify that the green RF IN lamp lights at all frequencies.

6. Reset the signal generator controls for a 500 MHz, CW, +13 dBm (1 VRMS) output.

7. The light should be lit as in previous steps.

8. If available, apply a 5 VRMS signal at 500 MHz to the RF IN connector and verify that the lamp is lit.

9. Remove the cable from the RF IN connector and verify that the lamp goes out.

10. If the requirements of Steps 1 through 9 are met, place a check mark on line 49 of the PTR.

4.20 TUNING NULL TEST

SPECIFICATION

A tuning null is indicated on the front-panel METER when the external and internal RF frequencies match for an external frequency range of 30 MHz to 500 MHz (METER FUNCTION switch set to TUNE).

METHOD

The output of a signal generator operating in CW mode is applied to the RF IN connector in the tune mode. The CW frequency of the instrument is varied, and the null is observed on the front-panel METER.

EQUIPMENT

(11)

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	499.450 MHz
MODULATION MODE	CW
MODULATION FREQ	EXT
MODULATION FM/AM	0
OUTPUT VERNIER	N/A
OUTPUT Step Attenuator	N/A
METER FUNCTION	DEVIATION, TUNE

2. Connect the RF output of the signal generator to the RF IN connector.

3. Set the signal generator controls for a 499.950 MHz, CW, -27 dBm output.

4. Observe the instrument front-panel METER and tune the frequency selector in 10 kHz steps for a null of 1 division or less on the 5 division METER scale. NOTE: A 10 kHz change in the vicinity of the null should result in an approximate 0.1 division change in the METER reading.

5. If the null is obtained at a Frequency selector setting of 499.950 MHz, place a check mark on line 50 of the PTR.

4.21 DEVIATION ACCURACY TEST

SPECIFICATION

4% FS at 1 kHz; 6% FS from 100 Hz to 8 kHz (includes 2% FS calibration error).

METHOD

The output of a signal generator with calibrated FM is applied to the RF IN connector in the deviation mode to verify that the indicated deviation is within specifications.

EQUIPMENT

(3) (4) (7) (11)

NOTE: The residual FM of the signal generator should be <100 Hz in a 50 Hz to 15 kHz bandwidth. See the note following the table in Step 13.

PROCEDURE

1. Set the instrument controls as follows:

FREQ VERNIER	CAL
Frequency selector	100.000 MHz
MODULATION MODE	CW
MODULATION FREQ	EXT
MODULATION FM/AM	0
OUTPUT VERNIER	N/A
OUTPUT Step Attenuator	N/A
METER FUNCTION	DEVIATION, -x100

2. Connect the equipment as shown in Figure 4-8.

3. Set the signal generator controls for a 100.000 MHz 0 dBm output with no modulation.

4. Set the frequency counter to read frequency to 7 places. The counter should read 100,000.0 ±10 kHz. Make a note of the reading to 7 places.

5. Set the oscilloscope for an A vs B display, and set channel B controls for a 20 mV/division DC sensitivity. Use the B position control (horizontal) to locate the spot on the vertical line at the left edge of the graticule.

6. Change the signal generator frequency to produce a 500 kHz increase in the frequency counter reading noted in Step 4.

7. Use the B channel sensitivity vernier to locate the spot on the vertical line at the right edge of the oscilloscope graticule. Remove the DC modulation from the signal generator. The spot should be located as in Step 5, and the frequency counter should read as in Step 4.

8. Repeat Steps 5 through 7 until the oscilloscope horizontal sensitivity is calibrated at 50 kHz division without further fine adjustments of the oscilloscope and signal generator controls.

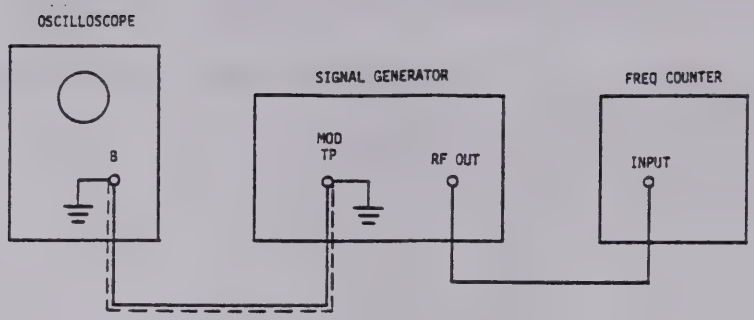


Figure 4-8. Deviation Test Set-up #1

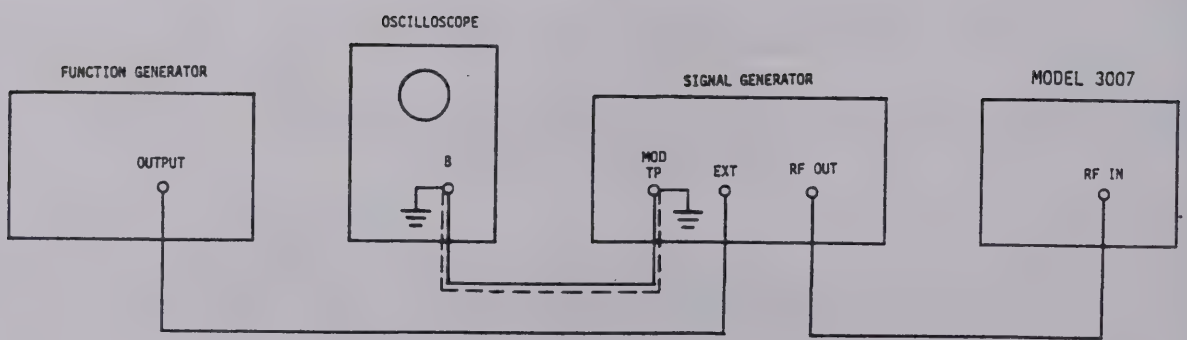


Figure 4-9. Deviation Test Set-up #2

9. Without changing the equipment control settings, connect the equipment as shown in Figure 4-9.

10. Set the function generator for a 1 kHz sine wave and adjust the output level for a 10 division linear horizontal display (10 division peak sine wave) on the oscilloscope graticule. The horizontal deflection to the right of zero indicates the peak amplitude of the sine wave, and disregards the off-scale deflection to the left of zero on the graticule.

11. With the instrument controls set as in Step 1, the front-panel METER should read 5.0 ±0.2 divisions (-480 to -520 kHz). METER readings greater than 5.0 divisions can be determined by adjusting the function generator for a 5.0 division METER reading, and observing the decrease in deflection of the oscilloscope display. A deflection of 9.6 divisions on the oscilloscope display corresponds to a 5.2 METER reading.

12. Set the METER FUNCTION switch to DEVIATION +x100. The METER should read 5.0 ±0.2 divisions (480 to 520 kHz). Record the reading in kHz on line 52 of the PTR.

METER FUNCTION SWITCH POSITION	TOTAL HORIZONTAL OSCILLOSCOPE DEFLECTION	DEVIATION METER READING	ACTUAL DEVIATION LIMITS	(STEP 13) RECORD METER READINGS ON LINE OF PTR	
	Divisions	Divisions	± kHz	—	+
	10	4.8 to 5.2	480 to 520	51	52
	8	3.8 to 4.2	380 to 420	53	54
DEVIATION	6	2.8 to 3.2	280 to 310	55	56
± x100	4	1.8 to 2.2	180 to 220	57	58
	2	0.8 to 1.2	80 to 120	59	60
	0	-0.2 to 0.2	-20 to 20	61	62
	10	4.8 to 5.1	48 to 52	63	64
	8	3.8 to 4.2	38 to 42	65	66
	6	2.8 to 3.2	28 to 32	67	68
DEVIATION	4	1.8 to 2.2	18 to 22	69	70
± x10	2	0.8 to 1.2	08 to 12	71	72
	0	-0.2 to 0.2*	-02 to 02*	73	74

*NOTE: If the deviation exceeds the limit, a signal generator with a lower residual FM (<50 Hz in a 50 Hz to 15 kHz bandwidth) should be substituted for the measurement.

13. Repeat Steps 9 through 12, except adjust the function generator output for 8, 6, 4, 2, and 0 division peak sine waves as displayed by the oscilloscope. METER readings should be as shown in the table. Disconnect the function generator from the external input of the signal generator when making the 0 division reading.

Record readings on appropriate lines of the PTR as indicated in the table.

14. Set the instrument controls as in Step 1, except set the METER FUNCTION switch to DEVIATION -x10.

15. Reconnect the equipment as shown in Figure 4-8, and calibrate the setup for 50 kHz deflection (5 kHz/division) using the procedure in Steps 3 through 8 except modify the procedure as follows:

a. Set the frequency counter to read frequency to 7 places, and make a note of the reading.

b. Set oscilloscope controls as in Step 5 but with channel B controls set to 0.2 V/division.

c. Adjust the signal generator for a 50 kHz increase in the frequency counter reading in Step 6.

d. Repeat Steps 7 and 8 until the setup is calibrated at 5 kHz/division.

16. Repeat Steps 9 through 13 for the DEVIATION +x10 and -x10 positions of the METER FUNCTION switch. Results should be as shown in the table. Record the readings on line 63 through 74 of the PTR.

17. Set the METER FUNCTION switch to DEVIATION +x10.

18. Set the function generator for a 1 kHz sine wave, and adjust the output for a reading of 40 kHz (4.0 divisions) on the front-panel METER.

19. Vary the frequency of the function generator from 100 Hz to 8 kHz, and verify that the METER reads between 3.9 and 4.1 divisions (39 to 41 kHz). Record the minimum reading in kHz on line 75, and the maximum reading on line 76 of the PTR.

20. Repeat Steps 18 and 19 with the METER FUNCTION switch set to DEVIATION -x10. Record the minimum reading in kHz on line 77, and the maximum reading on line 78 of the PTR.

21. Set the METER FUNCTION switch to DEVIATION +x100.

22. Set the function generator for a 1 kHz sine wave. Adjust the function generator output and the signal generator controls for a 400 kHz (4 division) reading on the front-panel METER.

23. Repeat Step 19 and verify that the METER reads between 3.9 and 4.1 divisions (390 to 410 kHz). Record the minimum reading in kHz on line 79, and the maximum reading on line 80 of the PTR.

24. Repeat Steps 22 and 23 with the METER FUNCTION switch set to DEVIATION -x100. Record the minimum reading in kHz on line 81, and the maximum reading on line 82 of the PTR.

25. Set the function generator for a 1 kHz sine wave. Adjust the function generator and signal generator controls for a 400 kHz (4 division) reading on the METER. Synchronously tune the signal generator and instrument frequencies in 10 MHz steps between 30 and 500 MHz. Verify that the 400 kHz reading on the METER remains constant throughout the range except for switching transients. Place a check mark on line 83 of the PTR if the reading remains constant.

Other control settings within the limits of the specifications may be tested as desired by modifying the test procedure accordingly.

4.22 RF PROTECTION CHECK

The following procedure is recommended to ensure proper operation of the protection device. The top cover must be removed from the instrument.

With the instrument operating normally in the CW mode, set the output level to +5 dBm. Connect a 50 ohm detector to the RF OUT connector. The DC output of the detector should be monitored on a suitable oscilloscope. Set the output frequency to 50 MHz.

The circuitry in the M35-2 is checked by pushing the momentary switch located on top of the module. This switch lowers the trip level of the module. While holding down the switch, slowly increase the output of the unit using the VERNIER until the M35-2 trips. This causes the circuit breaker to

open and latch, the UNLEVELED light to flash, and the detected output displayed on the oscilloscope to go to zero. The circuit breaker can then be reset by momentarily turning the POWER switch off. The M35-1 should have tripped at +7.5 dBm ±1 dB, Perform the same test at 520 MHz. It should then trip at an output level of +10.5 dBm ±2 dB.

The above procedure, while not a complete performance check, is considered adequate for most applications. Additional tests can be performed as desired. For example, insertion loss and VSWR can be checked in the same manner as any passive device. Also, if available, a high power RF signal source, set for an output of slightly over .7 W can be used to verify circuit breaker operation.

If the M35-2 is operating properly, place a check mark on line 84 of the PTR.

PERFORMANCE TEST RECORD
MODEL 3007

S/N_____
DATE_____

SEC	TEST	MINIMUM SPECIF	MEASUREMENT		MAXIMUM SPECIF	LINE
4.2	FREQ RANGE	----------	( ) CHECK		----------	1
4.3	FREQ ACCURACY	39,999.60 kHz		kHz	40,000.40 kHz	2
		1,039.99 kHz		Hz	1,060.01 kHz	3
		1,489.99 kHz		Hz	1,510.01 kHz	4
		2500 Hz		Hz	3500 Hz	5
				Hz		6
4.4	FREQ STABILITY			Hz	104 Hz	7
				Hz	500 Hz	8
4.5.1	METER ACCURACY	-0.5 dB		dB	+0.5 dB	9
				dB		10
4.5.2	FLATNESS	-0.75 dB		dB	+0.75 dB	11
				dB		12
				dB		13
4.5.3	STEP ATT ACCURACY	-0.7 dB		dB	+0.7 dB	14
				dB		15
				dB		16
				dB		17
		-1.5 dB		dB	+1.5 dB	18
4.6	HARMONICS	26 dB down		dB		19
				dB		20
		30 dB down		dB		21
				dB		22
4.7	NON-HARMONICS	60 dB down		dB		23
		65 dB down		dB		24
		55 dB down		dB		25
		35 dB down		dB		26
4.8	RESIDUAL AM	65 dB down		dB		27
4.9	RESIDUAL FM			Hz	200 Hz	28
4.10	INT MOD FREQUENCY	380 Hz		Hz	420 Hz	29
		950 Hz		Hz	1050 Hz	30
4.11	FM/AM CONTROL ACC	1.300 VDC		VDC	1.700 VDC	31
		4.300 VDC		VDC	4.700 VDC	32
	AM SYSTEM ACCURACY	26%		%	34%	33
		86%		%	94%	34
4.12	AM BANDWIDTH			dB	3 dB	35
4.13	AM DISTORTION			%	3%	36
				%	5%	37
4.14	FM DEVIATION ACC			kHz		38
				kHz		39
		47.500 kHz		kHz	52.500 kHz	40
				kHz		41
				kHz		42
		475.0 kHz		kHz	525.0 kHz	43
4.15	FM BANDWIDTH			dB	3 dB	44
4.16	FM DISTORTION			%	4%	45
				%	4%	46
4.17	IMPEDANCE	19 dB down		dB		47
4.18	RFI			dBm	-107 dBm	48

PERFORMANCE TEST RECORD
MODEL 3007

SEC	TEST	MINIMUM SPECIF	MEASUREMENT	MAXIMUM SPECIF	LINE
4.19	INPUT LEVEL		( ) CHECK		49
4.20	TUNING NULL		( ) CHECK		50
		-480 kHz	kHz	-520 kHz	51
		+480 kHz	kHz	+520 kHz	52
		-380 kHz	kHz	-420 kHz	53
		+380 kHz	kHz	+420 kHz	54
		-280 kHz	kHz	-320 kHz	55
		+280 kHz	kHz	+320 kHz	56
		-180 kHz	kHz	-220 kHz	57
		+180 kHz	kHz	+220 kHz	58
		-80 kHz	kHz	-120 kHz	59
		+80 kHz	kHz	+120 kHz	60
		+20 kHz	kHz	-20 kHz	61
		-20 kHz	kHz	+20 kHz	62
		-48 kHz	kHz	-52 kHz	63
		+48 kHz	kHz	+52 kHz	64
4.21	DEVIATION ACCURACY	-38 kHz	kHz	-42 kHz	65
		+38 kHz	kHz	+42 kHz	66
		-28 kHz	kHz	-32 kHz	67
		+28 kHz	kHz	+32 kHz	68
		-18 kHz	kHz	-22 kHz	69
		+18 kHz	kHz	+22 kHz	70
		-8 kHz	kHz	-12 kHz	71
		+8 kHz	kHz	+12 kHz	72
		+2 kHz	kHz	-2 kHz	73
		-2 kHz	kHz	+2 kHz	74
		+39 kHz	kHz		75
			kHz	+41 kHz	76
		-39 kHz	kHz		77
			kHz	-41 kHz	78
		+390 kHz	kHz		79
			kHz	+410 kHz	80
		-390 kHz	kHz		81
			kHz	-410 kHz	82
			( ) CHECK		83
4.22	RF PROTECTION		( ) CHECK		84

5.1 INTRODUCTION

This section provides information for disassembling, calibrating and troubleshooting the Signal Generator.

Measurements and adjustments will be facilitated by placing the instrument on its right side, as access is required to the top and bottom of the instrument for adjustments and test points.

5.2 SERVICE INFORMATION

5.2.1 DISASSEMBLY INFORMATION

Refer to Figure 5-1. The side panels form part of the support for the top and bottom covers; therefore, these covers should be removed before removing either side panel. The covers and panels can be removed as indicated below.

NOTE

One side panel must remain on the instrument to secure the front-panel assembly to the chassis.

REMOVAL OF BOTTOM COVER - Remove the two rear feet (A) and lift the cover off with a slight rear movement. Reinstall the cover by reversing the removal procedure.

REMOVAL OF FRONT-TOP AND FRONT-BOTTOM RAILS - The rails may be removed to facilitate removal of the Meter Board or Modulation Board assembly. Each rail is removed by removing the three screws (D) holding the rail to the instrument.

REMOVAL OF SIDE PANEL - Either side panel can be removed to provide better access by removing the six screws (E) holding the side panel to the instrument.

CAUTION

To prevent possible damage when reinstalling side panels, use only the original screws or equivalent. Longer screws in the bottom two holes can cause damage to wiring.

5.2.2 MODULE SERVICING

REMOVAL OF MODULE

A module may be removed by removing any cables attached to top of the module and removing the hold-down screw from the bottom. Rock the module slightly while lifting upward to free it from its chassis socket.

REINSTALLING MODULE

Before installing the module, check that all module pins are straight and properly aligned; then, carefully seat the module pins into the chassis socket. Replace the module hold-down screw to ensure a good ground connection between the module and chassis, and replace any cables attached to the top of the module. Module cable connections are shown in Figure 5-6.

NOTE

If a module is replaced with a new module, it will be necessary to calibrate the phase-locked loop or other circuits involved (see Table 5-3).

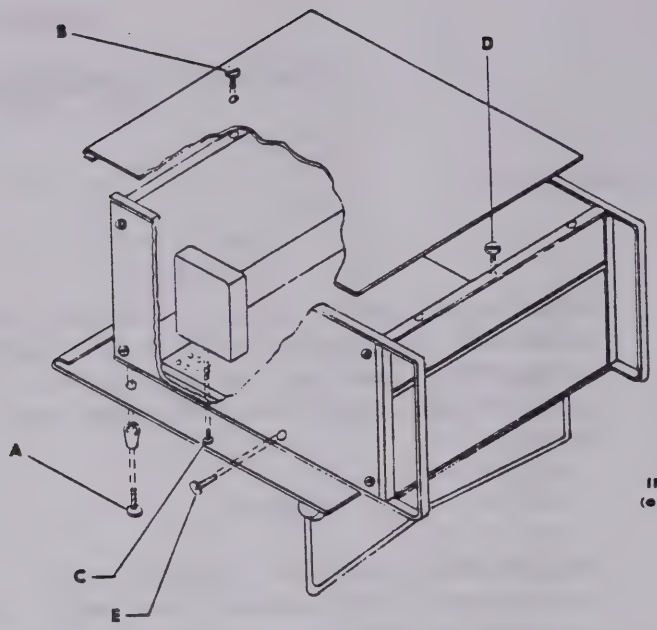


Figure 5-1. Dissassembly

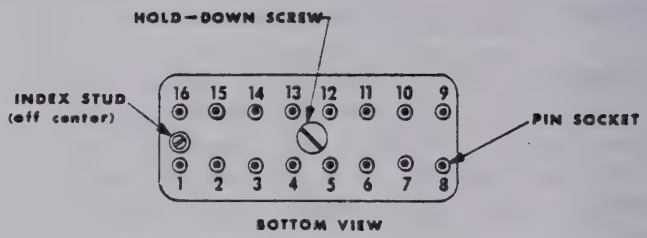


Figure 5-2. Module Pin Numbering System

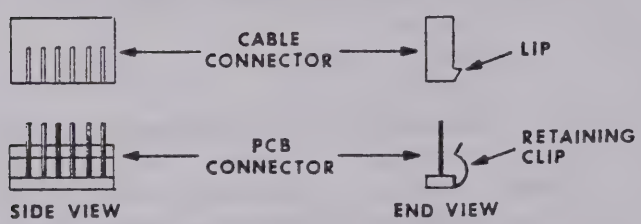


Figure 5-3. Connector Alignment

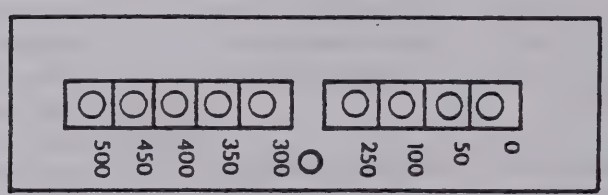
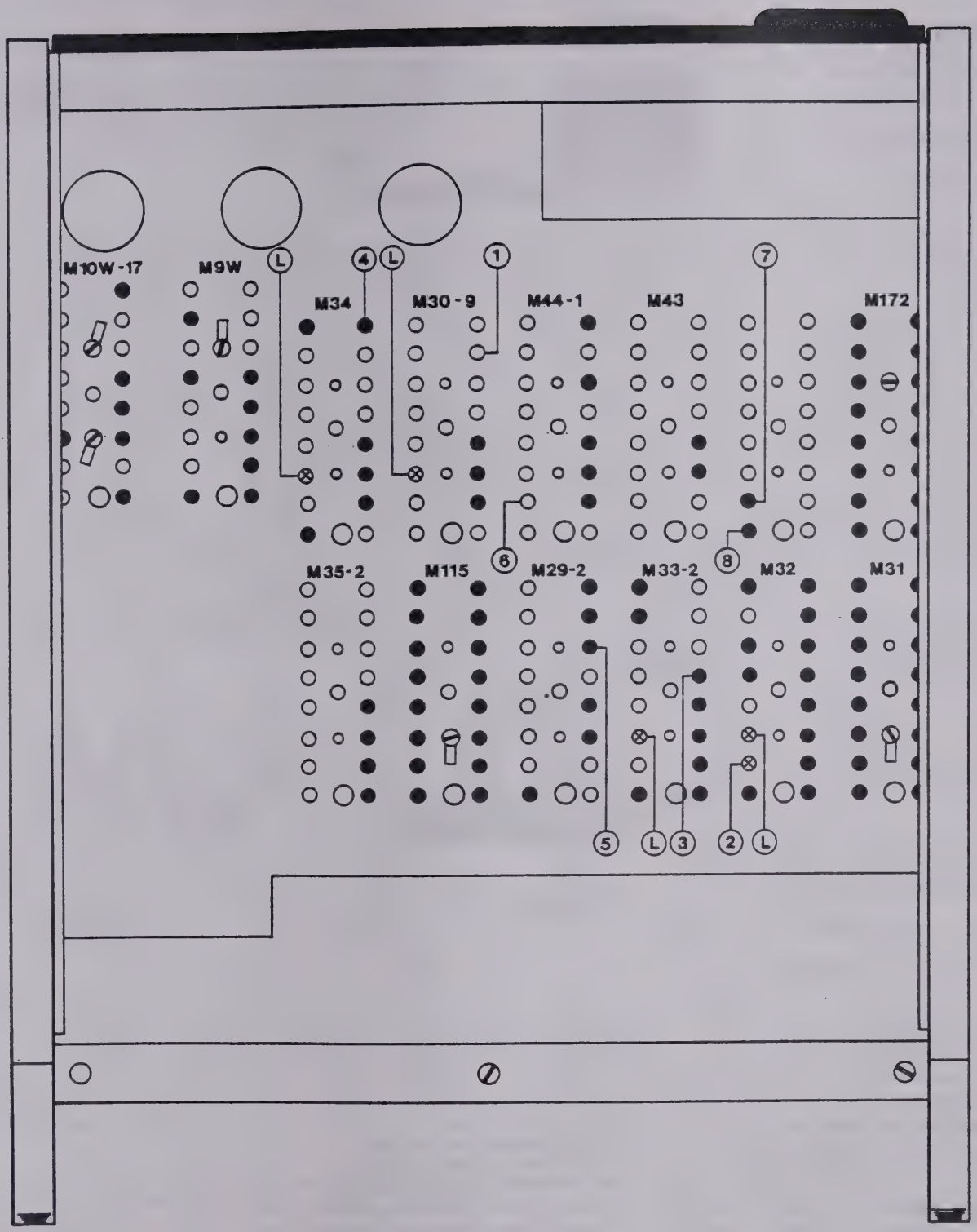


Figure 5-4. M172 Adjustments



TEST POINT

1. FREQUENCY ADJUST
2. PLL 2 T.P.
3. PLL 3 T.P.
4. PLL 4 T.P.
5. PLL 5 T.P.
6. -18 FOR TEST
7. EXTERNAL METER
8. MODULATION T.P.

L. LEVELER T.P.

WIRE COLOR CODE

Green	+7.3 V
Orange	+18 V
Yellow	-18 V

(Others Unassigned)

1) DPS2A POWER SUPPLY
   A - +18 V ADJ
   B - -18 V ADJ
   C - FUSE 2 AT

2) M172 SWEEP DRIVE/DAC

3) NOT USED

4) M43 AMPLIFIER/MIXER

5) M44-1 FM DISCRIMINATOR

6) M30-9 XTAL REF
   A - 1440 MHZ ADJ
   B - 1440 MHZ ADJ

7) M34 WIDE OSC LOCK
   A - RF TEST POINT
   B - UNLOCK INDICATOR

8) M9W SWEEP OSC
   A - WIDE OSC CENT ADJ
   B - WIDE OSC LEV ADJ
   C - NARROW OSC SW ADJ
   D - NARROW OSC LEV ADJ

9) M10W-17 OUTPUT AMP

10) M31A KHZ STEPS
   A - UNLOCK INDICATOR

11) M32A MHZ STEPS
   A - 000 MHZ ADJ
   B - 039 MHZ ADJ
   C - UNLOCK INDICATOR

12) M33-2 NARROW OSC LOCK
   A - RF TEST POINT
   B - UNLOCK INDICATOR

13) M29-2 FM REFERENCE
   A - 2.1 MHZ ADJ
   B - 2.0 MHZ ADJ

14) M115 DOWN CONV
   A - 10 MHZ TP
   B - GAIN ADJ

15) M35-2 RF CKT BRKR
   A - PUSH TO TEST

16) 50130-1 STEP ATTENUATOR

17) C316-7 MODULATION BD
   A - +5 V ADJ
   B - FMx1 ADJ
   C - SIZE ADJ
   D - BALANCE ADJ

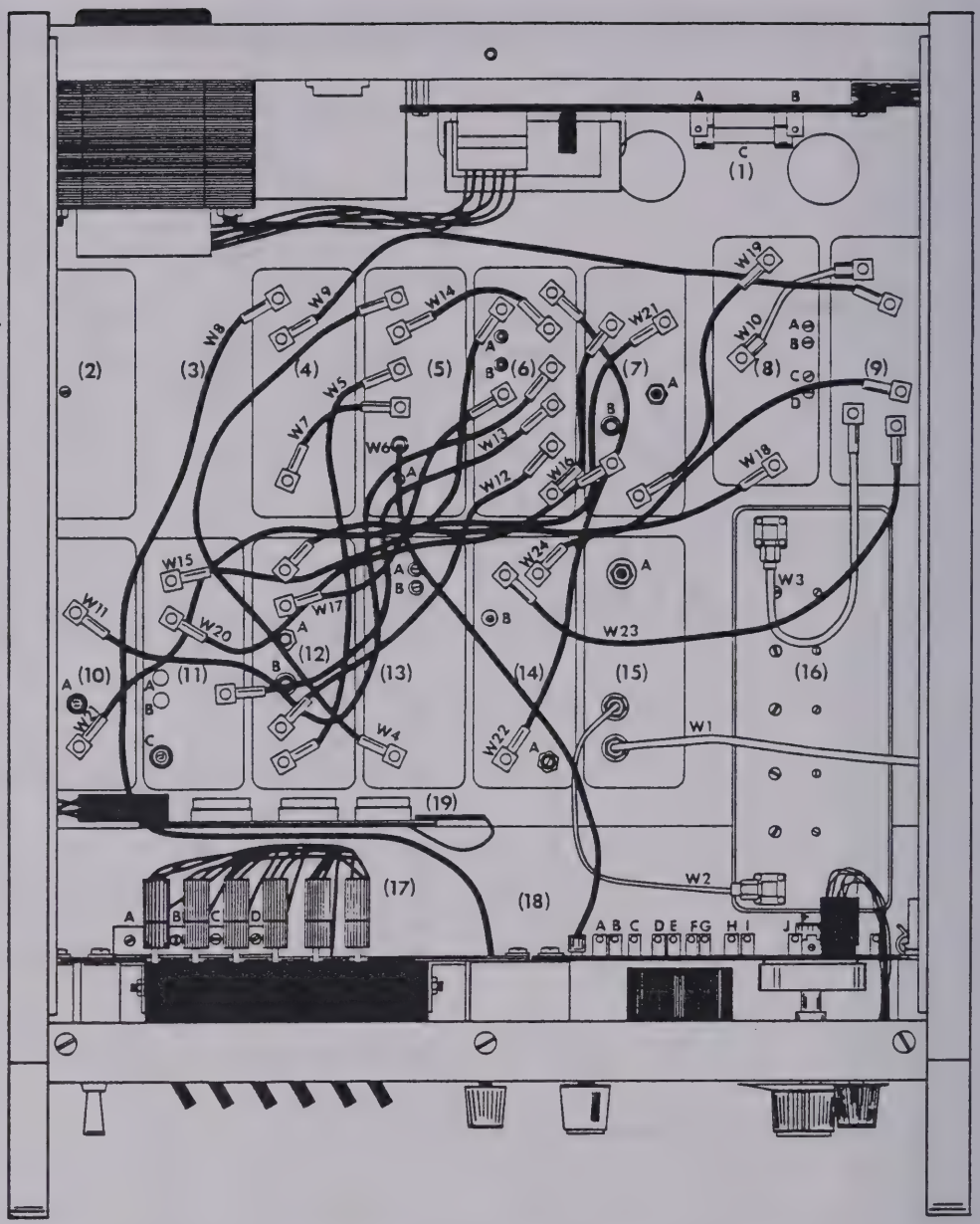


Figure 5-6. Adjustment Controls and Cable Connections

18) B006 METER BD
   A - DEVIATION x10 CAL
   B - DEVIATION x100 CAL
   C - DEVIATION x10 BALANCE
   D - OUTPUT METER CAL
   E - 0 DBM RANGE +3 DBM ADJ
   F - 0 DBM RANGE -7 DBM ADJ
   G - +10 DBM RANGE +3 DBM ADJ
   H - +10 DBM RANGE +13 DBM ADJ
   I - OUTPUT METER BALANCE
   J - AM% MOD ADJ
   K - DEVIATION x100 BALANCE
   L - DEVIATION METER CAL

19) 2 MHZ OFFSET BD.

MODULE PIN NUMBERING SYSTEM

The module pins are numbered as shown in Figure 5-2. The off-center index stud prevents the module's being plugged in backwards, and also provides a method for locating pin 1.

NOTE

Not all 16 pins are not required in each module. Only the pins actually used are installed, but the numbering system remains the same.

5.2.3 PRINTED CIRCUIT BOARD SERVICING

PRINTED CIRCUIT BOARD CONNECTORS

When reinstalling a harness connector on a printed circuit board, be sure the connector is properly aligned with the board connector pins and that the connector faces the proper direction.

METER BOARD REMOVAL

Removal of the Meter Board assembly requires that the OUTPUT Attenuator dial, VERNIER knob, METER FUNCTION knob and retaining nut, and front-top rail be removed. The Meter Board is secured to the front panel by two screws - one at each top corner of Meter Board. Remove these screws and disengage all slip-on wire connectors from the Attenuator switch. The Meter Board assembly can then be moved rearward until the VERNIER potentiometer shaft, UNLEVELED and RF IN lamps, and METER case clear the front panel. The board can then be lifted from the instrument.

The Meter Board is reinstalled by reversing the removal procedure. When installing the Meter Board, use care not to damage the UNLEVELED and RF IN lamps or the METER FUNCTION switch.

MODULATION BOARD REMOVAL

To remove the Modulation Board assembly, first remove the front-top and front-bottom rails. Disengage the slip-on connectors from the six FREQUENCY selector switches and the twelve-pin connector from the Modulation Board. Unsolder the wire from EXT modulation connector and remove the retaining nut from the backside of this BNC connector. Remove the black spring-loaded knobs from the MODULATION MODE and FREQ switches and the knob from the FREQ VERNIER potentiometer shaft. Remove one screw from the top-left corner of the Modulation Board and one screw from the top-left corner of the Meter Board. The Modulation Board can now be angled until the switch levers clear the front panel. The assembly then can be lifted from instrument.

The assembly is reinstalled by reversing the removal procedure.

POWER SUPPLY BOARD REMOVAL

The Power Supply board and heatsink can be removed by removing the four screws which secure the printed circuit board to the instrument rear panel. After removal of the connecting harness, the board can be carefully lifted from the instrument.

CAUTION

The Power Supply board may be raised far enough to allow checking of many components with the harnesses still connected; however, power must NOT be applied to the instrument unless the negative (ground) side of C10 is connected to the instrument chassis ground and to the positive (ground) side of C9 (jumper wires are sufficient).

The Power Supply board is reinstalled by reversing the removal procedure.

5.2.4 RECOMMENDED TEST EQUIPMENT

The test equipment numbered (1) through (8) in Table 4-1 is recommended for servicing, troubleshooting and calibrating the instrument. Additionally, a function generator (Wavetek Model 144 or equivalent) is required.

5.3 CALIBRATION PROCEDURE

Remove the instrument top and bottom covers and the card cage cover. Allow a two-hour warmup period before calibrating. In general, calibration should be performed in the sequence given. Test point and adjustment locations are shown in Figures 5-5 and 5-6.

NOTE

All measurements are made with reference to chassis ground.

5.3.1 +18 VOLT ADJUSTMENT

Connect the digital voltmeter to the orange +18 volt line on pin 3 of the Crystal Reference module. Set the +18 V Adj on the Power Supply to produce a +18.00 V reading.

5.3.2 -18 VOLT ADJUSTMENT

Connect the digital voltmeter to the yellow -18 volt line on pin 4 of the Crystal Reference module. Set the -18 V Adj on the Power Supply to produce a -18.00 V reading.

5.3.3 +7.3 VOLT CHECK

Connect the digital voltmeter to the green +7.3 volt line on pin 2 of the Crystal Reference module. The reading must be +7.3 V $\pm$150 mV.

5.3.4 CRYSTAL REFERENCE FREQUENCY ADJUSTMENT

Connect the frequency counter to the instrument RF OUT connector.

Set the instrument controls as follows:

FREQUENCY selector	500.000 MHz
FREQ VERNIER	CAL
MODULATION MODE	CW
MODULATION FREQ	EXT
MODULATION FM/AM	minimum
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm
METER FUNCTION	OUTPUT

Adjust the Crystal Reference module Frequency Adjust trimmer for a minimum-frequency indication on the counter; then, carefully turn the Frequency Adjust trimmer clockwise until the counter indicates 500.0000 MHz. Disconnect the counter from the RF OUT connector. A final frequency check will be performed in Section 5.3.13.

5.3.5 PHASE-LOCKED LOOP 1 ADJUSTMENT

No adjustment is necessary.

5.3.6 PHASE-LOCKED LOOP 2 ADJUSTMENT

Set the FREQUENCY selector for 200.000 MHz. Connect the digital voltmeter to pin 14 of the MHz Steps module. This voltage should be between +0.5 and +2.5 VDC. If it is not, carefully adjust Crystal Reference module trimmers A and B to produce a minimum reading on the voltmeter. Enter a frequency of 239.000 MHz and note that the DVM reading is still within the above limits.

Set the FREQUENCY selector for 200.000 MHz and connect the oscilloscope vertical input (DC, 1 V/division) to pin 15 of the MHz Steps module. Adjust MHz Steps module control A for a 0 V oscilloscope indication. Set the FREQUENCY selector for 239.000 MHz and adjust MHz Steps module control B to again produce a 0 V oscilloscope indication.

5.3.7 PHASE-LOCKED LOOP 4 ADJUSTMENT

Calibration of PLL 4 involves the Sweep Oscillator, Wide Oscillator Lock, and Sweep Drive/DAC modules.

Set the FREQUENCY selector for 250.000 MHz. Connect the digital voltmeter to Sweep Drive/DAC module pin 8; then, adjust the Sweep Drive/DAC module 250 MHz Adj for a 0.00 V reading on the voltmeter. The voltmeter may now be disconnected.

Connect a frequency counter to the RF OUT connector and connect the oscilloscope vertical input (DC, 1 V/division) to Wide Oscillator Lock module pin 8. Adjust Sweep Oscillator module control A for 0 $\pm$1 V on the oscilloscope. The counter should indicate a frequency of 250 MHz.

NOTE

Due to the way the Wide Oscillator Lock module locks on harmonics of 40 MHz, it is possible to adjust Sweep Oscillator module control A for 0 V at multiples of 40 MHz offset from 250 MHz. If this happens, it will be necessary to readjust Sweep Oscillator module control (A) several turns to break lock and relock at the next multiple of 40 MHz until 0 $\pm$1 V can be obtained with a 250 MHz counter reading.

Set the output frequency to 300 MHz and adjust the Sweep Drive/DAC module 300 MHz Adj for 0 $\pm$3 V on the oscilloscope with a counter reading of 300 MHz. Repeat this step, using the applicable Sweep Drive/DAC module Adj for frequencies of 350, 400, and 450 MHz.

Set the FREQUENCY selector for 500.000 MHz. Adjust the Sweep Drive/DAC module 500 MHz Adj for an oscilloscope reading near 0 V. Set the FREQUENCY selector for 520.000 MHz and note the oscilloscope indication; then, adjust the Sweep Drive/DAC module 500 MHz Adj to give oscilloscope indications at 500.000 and 520.000 MHz that are symmetrical about 0 V.

Set the FREQUENCY selector for 100.000 MHz and adjust the Sweep Drive/DAC module 100 MHz Adj for 0 $\pm$3 V on the oscilloscope and a counter reading of 100 MHz. Repeat using the appropriate Sweep Drive/DAC module Adj for frequencies of 50 and 0 MHz. (Set the FREQUENCY selector for 001.000 MHz for the 0 MHz adjustment.)

Connect the digital voltmeter to Wide Oscillator Lock module pin 14 (Leveler TP). Step through the frequency range from 1 to 520 MHz in 10 MHz steps to find the frequency having highest leveler voltage; then, adjust Sweep Oscillator module control B for +1.0 VDC at this frequency setting.

5.3.8 PHASE-LOCKED LOOP 3 ADJUSTMENT

PLL 3 consists of two modules: The Narrow Oscillator Lock module and the Sweep Oscillator module.

Set the FREQUENCY selector for 250.000 MHz. Connect the oscilloscope vertical input (DC, 1 V/division) to Narrow Oscillator Lock module pin 5. Adjust Sweep Oscillator module control D for a 0 V oscilloscope indication.

Set the MODULATION MODE to FMx10, the MODULATION FREQ to 1 kHz, and the MODULATION FM/AM slider full up. Set the oscilloscope vertical input for AC, 50 mV/division. Adjust Sweep Oscillator module control C for a minimum (null) indication of the 1 kHz sine wave on the oscilloscope.

5.3.9 PHASE-LOCKED LOOP 5 ADJUSTMENT

Connect the frequency counter to the front-panel RF OUT connector and the AC digital voltmeter to the MOD TP.

Set the instrument controls as follows:

FREQUENCY selector	2.000 MHz
FREQ VERNIER	0 kHz
MODULATION MODE	FMx10
MODULATION FREQ	DC
MODULATION FM/AM	Full up
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm
METER FUNCTION	OUTPUT

NOTE

The Modulation Board contains a Size Adj (C) and a Balance Adj (D) which are factory adjustments. DO NOT change the settings of these two controls.

Adjust Modulation Board control (A) for a +5.00 ±.01 V reading on the voltmeter. Set the MODULATION FM/AM slider full down. The voltmeter should indicate 0 V ±20 mV. Disconnect the voltmeter from the MOD TP.

Adjust FM Reference module control (B) to produce a frequency counter reading of 2.000 MHz ±100 Hz. Set the MODULATION FM/AM slider full up and adjust FM Reference module control (A) for a counter reading of 2.500 MHz ±100 Hz.

Set the MODULATION MODE to FMx1 and adjust Modulation Board control (B) for a counter reading Of 2.050 MHz ±100 Hz.

5.3.10 METER BOARD CALIBRATION

Refer to Figure 5-6.

In order to adjust the front-panel METER, the instrument must be resting on its bottom surface (normal operating position). Turn off AC power to the instrument and mechanically zero the METER with the front-panel screwdriver adjustment located just below the METER face. Restore power to the instrument and allow it to stabilize.

Turn the OUTPUT VERNIER fully ccw and adjust Meter Board control (I) until the METER is again reading zero.

Turn the OUTPUT VERNIER fully cw and adjust Meter Board control (D) for a +3 dB METER reading.

Set the instrument controls as follows:

FREQUENCY selector	50.000 MHz
FREQ VERNIER	CAL
MODULATION MODE	CW
MODULATION FM/AM	Full down
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm
METER FUNCTION	OUTPUT

Calibrate the power meter and its sensor. Set the power meter to its +15 dBm range and connect it to the instrument RF OUT connector.

Adjust Meter Board control (H) for a +13 dBm power meter reading. Set the OUTPUT VERNIER for a -7 dB reading on the METER. Set the power meter to its +5 dBm range and adjust Meter Board control (G) for a +3 dBm power meter reading.

Since Meter Board controls (G) and (H) interact, repeat the above procedure until the proper power meter readings are obtained without further adjustment of the controls.

Set the OUTPUT Step Attenuator to 0 dBm and the power meter to the +5 dBm range. Turn the OUTPUT VERNIER fully cw. Adjust Meter Board control (E) for a +3 dBm power meter reading. Set the OUTPUT VERNIER for a -6 dB reading on the METER and set the power meter to its -5 dBm range. Adjust Meter Board control (F) for a -6 dBm power meter reading.

Since Meter Board controls (E) and (F) interact, repeat the above procedure until the proper power meter readings are obtained without further adjustment of the controls.

Using the test set-up of Figure 4-3, set the instrument controls as follows:

FREQUENCY selector	520.000 MHz
MODULATION MODE	AM
MODULATION FREQ	DC
OUTPUT Step Attenuator	0 dBm
OUTPUT VERNIER	+3 dBm

Set the MODULATION FM/AM slider to produce a reading of 4.5 VDC at the MOD TP. Adjust Meter Board control (J) for an average reading of 90% AM on the modulation meter. Set the OUTPUT VERNIER for a -7 dBm reading on the output METER and adjust Meter Board control (M) for a 90% AM average reading on the modulation meter. Repeat this procedure until the 90% AM average readings are obtained without further adjustment of Meter Board controls (J) and (M).

5.3.11 DOWN CONVERSION GAIN ADJUSTMENT

Set the instrument front-panel controls as follows:

FREQUENCY selector	001.000 MHz
FREQ VERNIER	CAL
MODULATION MODE	CW
MODULATION FREQ	N/A
MODULATION FM/AM	minimum
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	0 dBm

Connect the power meter to the instrument RF OUT connector. Note the output level reading. Set the FREQUENCY selector to 000.999 MHz, and adjust the Down Converter module Gain control such that the output level exactly matches the level noted at 001.000 MHz.

5.3.12 RF PROTECTION

The only maintenance for the RF circuit breaker is periodic testing to ensure its operation. If a malfunction occurs, the trouble can be localized and repaired with the aid of the theory of operation and the schematic. If the problem is a defective monitor diode, care should be observed to keep lead length and position the same as the original diode.

5.3.13 FINAL FREQUENCY CHECK

Connect the frequency counter to the instrument RF OUT connector and set the front-panel controls as in Section 5.3.4.

Note the frequency reading on the counter. If it does not agree with the selected frequency within accuracy specifications, very carefully adjust the Crystal Reference module Frequency Adjust trimmer until the desired frequency is obtained.

5.3.14 TUNE/DEVIATION MEASUREMENT SYSTEM

NOTE

Prior to calibration of the Tune/Deviation Measurement system, the calibration procedures for PLL 5 (Section 5.3.9) must be completed.

5.3.15 METER BOARD

Set the instrument controls as follows:

FREQUENCY selector	30.000 MHz
MODULATION MODE	AM
MODULATION FREQ	1 kHz
MODULATION FM/AM	Full up
METER FUNCTION	DEVIATION +x100

Set Meter Board Service switch S1 to its service (up) position and adjust Meter Board control (L) for full-scale deflection +0% -2% (1 minor division = 2%).

5.3.16 PROCEDURE FOR CALIBRATING DEVIATION OF WAVETEK MODEL 3007

The adjustments in Section 5.3.17 and 5.3.18 require a signal source with precisely calibrated ($\pm$1%) deviation (such as a Wavetek Model 3000 used in conjunction with a frequency counter). Calibrate the deviation using the following procedure.

Adjust the Model 3007 controls as follows:

FREQUENCY selector	40.000 MHz
MODULATION MODE	as required to obtain desired deviation (i.e. FMx1, or FMx10).
MODULATION FREQ	VERN
MODULATION FM/AM	Full down
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm

Connect the counter to the RF OUT connector and record the frequency ±20 Hz. Adjust the MODULATION FM/AM slider to change the counter reading by the desired deviation ±20 Hz. Set the MODULATION FREQ to 1 kHz. The Model 3000 is now calibrated to the desired deviation ±1%.

5.3.17 FM DISCRIMINATOR

The FM Discriminator module contains switching circuitry, phase-locked loop components, and active low-pass filters to provide a 5 V peak output signal to the Meter Board when the input signal deviation is 500 kHz.

Set the instrument controls as follows:

FREQUENCY selector	40.000 MHz
MODULATION MODE	CW
MODULATION FREQ	EXT
MODULATION FM/AM	Full down
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	+10 dBm
METER FUNCTION	TUNE
FREQ VERNIER	CAL

Connect the output of the signal source in Section 5.3.16 to the RF IN connector and adjust the source for a deviation of 500 kHz at a 1 kHz rate. Connect the DVM to the output (J5) of the FM Discriminator module. Adjust the FM Discriminator module Gain control for a 5.535 ±.005 VAC. reading Reconnect the coaxial cable to J5 and return the Meter Board Service switch to its normal (down) position.

5.3.18 DEVIATION METER ADJUSTMENTS

Set the instrument controls as follows:

FREQUENCY selector	40.000 MHz
FREQ VERNIER	CAL
MODULATION MODE	CW
METER FUNCTION	DEVIATION +x100

Connect the output of the signal source in Section 5.3.16 to the RF IN connector and adjust the source for a deviation of 450 kHz at a 1 kHz rate. Adjust Meter Board control (B) for a 4.5 reading. Set the METER FUNCTION switch to DEVIATION -x100. Adjust Meter Board control (K) for a 4.5 reading.

Adjust the deviation source for a deviation of 45 kHz. Set the METER FUNCTION switch to DEVIATION +x10. Adjust Meter Board control (A) for a 4.5 reading. Set the METER FUNCTION switch to DEVIATION -x10. Adjust Meter Board control (C) for a 4.5 reading. Externally modulate the deviation source with a function generator at a 1 kHz rate, and adjust the function generator to cause a 4.5 reading on the front-panel METER.

Set the frequency of the function generator to 8 kHz and, using a non-metallic screwdriver, adjust Meter Board trimmer C1 for a 4.45 reading. Verify that there is less than one minor division change as the function generator frequency is varied between 100 Hz and 8 kHz.

5.4 TROUBLESHOOTING

Effective troubleshooting requires a thorough understanding of the block diagrams and circuit descriptions located in Section 3 of this manual; then, the Performance Tests in Section 4 and Calibration Procedures in Section 5 will aid in localizing the trouble symptom to a particular module or PC board. Once this has been accomplished, the module or board can be replaced; or, repaired with the aid of

the proper schematic and parts layout diagram. In general, it is preferable to replace a defective module or PC board assembly.

Equipment troubles are frequently due simply to improper settings; therefore, before engaging in a troubleshooting procedure, be sure the instrument parameters are properly selected. Refer to the operating instructions in Section 2 of this manual for a complete explanation of each function along with typical operating instructions.

After verifying that the trouble is not improper setting of the controls or test setup, make a thorough visual inspection of the instrument for such obvious defects as loose or missing screws, broken wires, defective module pin sockets, loose RF cables, and burned or broken components. After localizing the problem, voltage and resistance checks will help find the defective component.

For troubleshooting purposes, it is permissible to operate the instrument with any of the plug-in modules, PC boards, or RF cables removed; however, the instrument should be turned off when removing or installing modules or PC boards. If substitute modules or boards are available, this provides an easy method of verifying if a suspected module or board is defective.

RF cables can be disconnected from the module output connectors; then, a power meter or spectrum analyzer can be connected directly to the module connector for power level or frequency measurements. Fabrication of a short coaxial adapter cable, terminated in a mating SMC or SMA connector for the modules on one end and a BNC connector on the other, will facilitate connection of test equipment.

The front-panel ACCURACY lamps, together with the four internal module "unlock indicator" lamps, aid in troubleshooting phase-locked loop problems. One module in each loop contains an indicator lamp which lights to indicate that the loop is unlocked. The lamps indicate only which loops are unlocked, but not which modules are at fault.

A problem in a power supply may cause many symptoms pointing to other areas, and should be checked when the symptom does not clearly indicate a specific problem. Loss of the -18 V supply, for example, will cause the ACCURACY lamps to flash, while loss of the +18 V supply will extinguish all lamps. The +18, -18, and +7.3 V supplies comprise the Power Supply which forms the rear panel of the instrument. Performance of these supplies is indicated in the Calibration Procedure.

5.4.1 TROUBLESHOOTING HINTS

Following is a list of several typical symptoms, accompanied by the possible cause(s) or a troubleshooting procedure. It is assumed the instrument has been properly calibrated previously, and that a warmup period will precede troubleshooting.

INTERMITTENT OPERATION - Defective module pin sockets or loose RF cables.

LOW OR NO RF OUTPUT (ANY RANGE) - Defective Attenuator or RF cables, Meter Board, Sweep Oscillator or Output Amplifier module, or a tripped RF Protection Circuit module.

If an external RF voltage of approximately 6 VRMS or more is accidentally applied to the instrument's RF OUT connector, an internal switch in series with the RF output will open. This prevents damage to the instrument's Attenuator or Output Amplifier. This open switch will be indicated on the front panel by the flashing of the UNLEVELED light. If the circuit breaker is tripped while the instrument is unleveled, the UNLEVELED light will vary in intensity instead of

flashing on and off. Once the switch is tripped, it will latch in the open position and remain open until reset. Also a combination of a high mismatch, high output level (>0.1 V) and changing frequency can cause the circuit breaker to trip. After removing the RF signal causing the overload, the switch can be reset by momentarily turning the front-panel POWER switch off.

Check the voltage on pin 15 of the Output Amplifier module. With the OUTPUT VERNIER fully clockwise, the voltage should be approximately -2.5 VDC on the +10 dBm range and -0.7 VDC on the 0 dBm range. These voltages indicate proper operation of the Meter Board, while other values, particularly positive voltages, indicate a defective IC or other problem on the Meter Board.

Next, check RF power directly at the Output Amplifier module output. If it is correct, the trouble lies in the Attenuator or its RF cables. If the output is low, measure the Sweep Oscillator module output. This should be approximately -10 or -11 dBm. If this level is correct, the Output Amplifier module is defective, while if the level is low, the Sweep Oscillator module is defective.

OUTPUT METER DOES NOT MOVE - If the METER is pegged at either end of the scale, the trouble is probably a defective component on the Meter Board, while if the METER remains at mechanical zero, the METER Movement may be open or a Meter Board component may be defective.

UNLEVELED INDICATOR ON - RF OUT connector not terminated in 50 ohm load; AM depth set so that peak of modulated output exceeds +13 dBm; defective Output Amplifier module; defective Step Attenuator or connecting RF cables.

Connect a power meter directly to the Output Amplifier module output and set the instrument controls for a +13 dBm output level at 50.000 MHz. Step through the frequency range of from 10 to 520 MHz in 10 MHz steps. A power meter reading of +13 dBm $\pm$0.5 dB with the UNLEVELED indicator off indicates proper operation of the Output Amplifier module. If the output is correct, but the UNLEVELED indicator is on, the trouble is probably a defective driver circuit in the Output Amplifier module. With proper operation of the Output Amplifier module, connect the power meter directly to the Step Attenuator output and repeat the above procedure. If the Attenuator output is correct, the trouble is due to a defective RF cable or possibly a poor ground connection at the RF OUT connector.

UNLOCKED INDICATOR - If the indicator is active in FM mode, but not in CW or AM modes, the problem probably is a defective FM Reference or Narrow Oscillator Lock module. If the indicator is active in all modes, one or more of the phase-locked loops is unlocked (see Phase-Locked Loop Troubles below).

PHASE-LOCKED LOOP TROUBLES - An open or unlocked loop, indicated by a lighted module lamp, can be caused by a number of factors including: low AC input voltage; low DC supply voltages; improper phase-locked loop DC voltages; an open or shorted RF cable; or a defective module.

A defective RF cable or module can have a "chain-reaction" effect that causes two or more loops to unlock. For example, loss of the 1 kHz signal to the kHz Steps module will cause PLL 1 to unlock; thus, the kHz Steps module may not supply a proper signal to the Wide Oscillator Lock module, causing PLL 4 to unlock.

Failure of the 40 MHz crystal oscillator in the Crystal Reference module will cause all loops to unlock, since all reference frequencies will be lost.

Table 5-1 lists typical RF signal-input levels for each of the phase-locked loops. Those signals having a TTL level or 1 V level may be measured with a high-frequency oscilloscope. The other signals are best measured with a spectrum analyzer (dBm), or a 50 ohm detector and calibrated oscilloscope (mV).

NOTE

The TTL waveform shown in Table 5-1 is for illustration of voltage values only, and does not necessarily represent the observed waveshape.

Phase-Locked Loop 1 - Unlocking of this loop may be caused by a defective kHz Steps module, Crystal Reference module, or connecting RF cable.

If the kHz Steps module unlock indicator is on, check that the 1 kHz signal is as listed in Table 5-1. If the signal is correct, the Crystal Reference module is operating properly. Check the RF cable between the Crystal Reference module and the kHz Steps module. If the 1 kHz signal is being applied to the kHz Steps module, check for 7.3 V on pin 6, +18 V on pin 7, and -18 V on pin 8 of the kHz Steps module. If the input signal and DC voltages are correct, the kHz Steps module is defective.

Phase-Locked Loop 2 - Unlocking of PLL 2 can be caused by a defective Crystal Reference module, MHz Steps module, Sweep Drive/DAC module, or connecting RF cables.

Connect a digital voltmeter to MHz Steps module pin 11 and observe the voltmeter reading while stepping through the frequency range from 200 to 239 MHz in 1 MHz steps. The voltmeter reading should change -0.2 V per MHz from 0 V at 200 MHz to -7.8 V at 239 MHz. These voltages indicate proper operation of the Sweep Drive/DAC module.

The Crystal Reference module can be checked by measuring the 1 MHz and 1440 MHz signals directly at the Crystal Reference module. The levels specified in Table 5-1 indicate proper operation of the module. Check connectors and RF cables connecting the Crystal Reference module to the MHz Steps module. Check for +18 V on pin 7, -18 V on pin 8, and +7.3 V on pin 9 of the MHz Steps module. If all input signals and DC voltages to the MHz Steps module are normal, but the MHz Steps module lamp is on, the MHz Steps module is defective.

Phase-Locked Loop 4 - Unlocking of PLL 4 may, under certain conditions, be caused by problems originating in the other loops. Therefore, PLL 1, 2, and 3 should be operating properly before troubleshooting PLL 4.

Unlocking of PLL 4 can be caused by a defective Sweep Oscillator module, Crystal Reference module, kHz Steps module, MHz Steps module, Wide Oscillator Lock module, Sweep Drive/DAC module, or connecting RF cables.

Connect a digital voltmeter to Sweep Drive/DAC module pin 8. The voltmeter reading should be +5 to +8 V at 000 MHz, 0 V at 250 MHz, and -6 to -10 V at 500 MHz. If these voltages are obtained, the Sweep Drive/DAC module is operating properly.

Measure the wide oscillator signal at the Sweep Oscillator module. The frequency will be between 1198 MHz and 1718 MHz, depending upon the output frequency selected. If the signal level is as specified in Table 5-1, the Sweep Oscillator module is probably operating properly.

Measure the 40 comb line at the Crystal Reference module. The 40 MHz harmonics from 40 MHz to 280 MHz should be fairly equal in amplitude, and the level should be as specified in Table 5-1. This level indicates proper operation of the Crystal Reference module.

Measure the 1448 MHz to 1487 MHz signal at the MHz Steps module. The exact frequency is dependent upon the MHz portion of the output frequency selected. If the level is as specified in Table 5-1, the MHz Steps module is operating properly.

Next, measure the 10.000 to 9.001 MHz output of the kHz Steps module. The output will be 10.000 MHz when the kHz portion of the output frequency is 000, and will decrease to 9.001 MHz when the kHz portion is 999. If the signal level is as specified in Table 5-1, the kHz Steps module is operating properly.

If the output of each of the above modules is correct, check the connectors and connecting RF cables. Check for +7.3 V on pin 2, +18 V on pin 3, and -18 V on pin 4 of the Wide Oscillator Lock module. If all input signals and DC voltages to the Wide Oscillator Lock module are correct, but the Wide Oscillator Lock module lamp is on, the Wide Oscillator Lock module is probably defective, but the trouble could be caused by the Sweep Oscillator module.

A further check of the Wide Oscillator Lock module can be made by monitoring module pin 8 with a digital voltmeter while stepping through the frequency range of from 10 MHz to 520 MHz in 10 MHz steps. The voltmeter reading should be 0 $\pm$3 V; however, a defective the Wide Oscillator Lock module may give a voltage reading of 12 to 16 volts.

NOTE

It is possible for a defective Wide Oscillator Lock module to cause the ACCURACY lamps to flash without lighting the PLL 4 lamp. In such cases, there will be excessive noise observable on pin 8 of the module, and pin 9 will be +12 V.

Phase-Locked Loops 3 and 5 - The LED indicator on the Narrow Oscillator Lock module serves both PLL 3 and PLL 5. If the Narrow Oscillator Lock module lamp is on, determine which loop is defective by selecting FM mode. If the Narrow Oscillator Lock module lamp goes off, the trouble is in PLL 5. If the lamp stays on, the trouble is in PLL 3.

PLL 3 consists of the Narrow Oscillator Lock module and the Sweep Oscillator module. It is possible that PLL 3 can be restored to operation simply by recalibrating per Section 5.3.8, and this should be attempted. If adjusting Sweep Oscillator module control D has no effect on the Narrow Oscillator Lock module pin 5 voltage, the problem is in the Narrow Oscillator Lock module; however, if the pin 5 voltage changes, but phase lock cannot be established, or if the pin 5 voltage cannot be set to within 5 volts of 0 V, the trouble is in the Sweep Oscillator module. Measure the Narrow Oscillator Lock module Leveler TP (pin 14) voltage. If it is between +0.5 and 5 VDC, the trouble is probably in the Narrow Oscillator Lock module; however, if it is greater than 5 VDC, the trouble is probably in the Sweep Oscillator module or the Crystal Reference module. Check the Crystal Reference module reference frequencies and the Sweep Oscillator module output level as shown in Table 5-1 to determine which module is defective.

PLL 5 consists of the FM Reference module and the Narrow Oscillator Lock module. In CW mode, measure the PLL 5 voltage on FM Reference module pin 6. Adjust FM Reference module control B for 0 V on pin 6. If, while adjusting the control, this voltage does not move, the problem is in the Narrow Oscillator Lock module. If the voltage adjusts, but the loop will not lock, the trouble is in the FM Reference module.

DOWN CONVERSION TROUBLES - Problems in the down conversion circuitry (Down Converter and Output Amplifier modules) can cause a variety of problems.

If the instrument operates properly from 1 to 520 MHz, but not from 1 to 999 kHz, the problem probably lies in either the Down Converter or Output Amplifier module. Check for the TTL switching signal at pin 5 of the Output Amplifier module. If the signal is correct (0 V above 1 MHz, 3 V below 1 MHz), check to see that the RF signal is being switched to the Down Converter module for output frequencies below 1 MHz. If the switch is working, the problem lies in either the Down Converter module or a connecting cable. If the instrument output frequency is 10 MHz higher than the programmed frequency (for example, 10.420 MHz instead of 420 kHz), and the TTL signal at pin 5 of the Output Amplifier module is correct, the switch is not working, and the problem lies in the Output Amplifier module.

If the instrument operates properly from 1 to 999 kHz, but not above 1 MHz, check for the TTL signal at pin 5 of the Output Amplifier module. If it is correct, the problem lies in the Output Amplifier module.

If the RF output level from 1 to 999 kHz is too low, and cannot be corrected by recalibration, the problem lies in either the Down Converter module or a connecting cable.

FREQUENCY SELECTOR - Troubles in the switch circuits may be caused by a defective switch, loose or disengaged switch connector, a broken switch wire, or a defective component on the Offset Board.

Five of the switches utilize four wires plus a ground to select decimal digits from 0 through 9. The 100's MHz switch uses three wires plus ground, since it only needs to select digits between 0 and 5. A "BCD Truth Table", applicable to each of the six switches, is given in Table 5-2.

Suspected switch problems can be checked by referring to Table 5-2 and the instrument Wiring Diagram to determine which module pins are grounded for a particular frequency. For example, to select a frequency of 200.500 MHz, Sweep Drive/DAC module pin 3 is grounded by selecting digit 2 on the 100's MHz switch, and kHz Steps module pins 2 and 4 are grounded by selecting digit 5 on the 100's kHz switch.

MODULATION TROUBLES - The Modulation Board is the most common cause of modulation problems, particularly when the modulating signal is lost. Nonlinear amplitude modulation at higher audio frequencies from an external source may be caused by the Output Amplifier module.

Set the front-panel controls as follows to determine the presence of a modulating signal:

FREQ VERNIER	CAL
MODULATION MODE	AM
MODULATION FREQ	400 Hz
MODULATION FM/AM	Full up
OUTPUT VERNIER	Full cw
OUTPUT Step Attenuator	0 dBm
METER FUNCTION	OUTPUT

Connect the oscilloscope vertical input to the MOD TP. The oscilloscope should display a 10 Vpp sine wave at a frequency of 400 Hz (2.5 msec period). If the 10 Vpp signal is not obtained, check for +7.3 V on pin 8, +18 V on pin 1, and -18 V on pin 2 of the Modulation Board. If the DC voltages are normal, the Modulation Board is defective.

AM Troubles - Connect the oscilloscope vertical input to pin 4 of the Meter Board and check for a 10 Vpp sine wave. Presence of the sine wave at this point indicates proper operation of the Modulation Board and wiring.

Connect the oscilloscope vertical input to pin 2 of the Meter Board and check for a sine wave having an approximate amplitude of 1.75 Vpp. If the 1.75 V signal is not present, check for +18 V on pin 6 and -18 V on pin 5 of the Meter Board. If DC voltages are normal, the Meter Board is defective or a wire is disconnected from Attenuator switch S1.

Check for the 1.75 Vpp sine wave on pin 15 of the Output Amplifier module. If the sine wave is normal at this point, but amplitude modulation is abnormal, the Output Amplifier module is defective.

FM Troubles - Set the MODULATION MODE switch to FMx10. Connect the oscilloscope vertical input to pin 16 of the FM Reference module and check for a 10 Vpp sine wave. A 10 Vpp sine wave at this point indicates proper operation of the Modulation Board and wiring.

Remove the RF cable from the top of the FM Reference module; then, check for a 1 Vpp 1.5 to 2.5 MHz signal at this connector. If this signal is not present, check for +18 V on pin 3 and -18 V on pin 4 of the FM Reference module. If the DC voltages are normal, the FM problems are caused by a defective FM Reference module. If the 1.5 to 2.5 MHz signal is present at the FM Reference module connector, the FM problems are probably caused by a defective Narrow Oscillator Lock module.

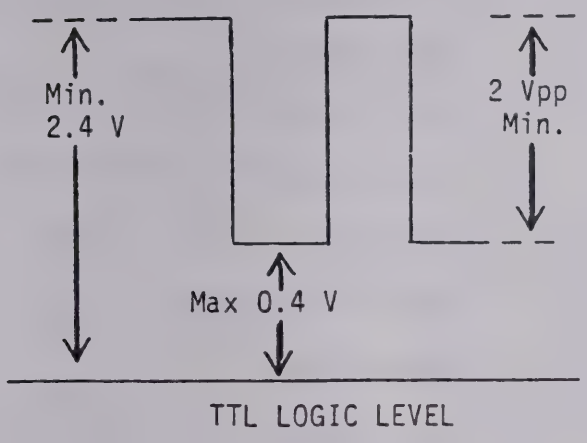
TUNE/DEVIATION TROUBLES - If the instrument operates correctly in OUTPUT mode but not in TUNE and DEVIATION modes, the trouble lies in either the FM Discriminator or Mixer/Amplifier module, or possibly the METER FUNCTION switch or Output Amplifier module. Also verify that the Meter Board Service switch (S1) is in its normal (down) position.

5.4.2 ASSEMBLY REPLACEMENT

While in many cases the instrument will work satisfactorily after simply replacing a defective module or PC board, to maintain the high accuracy of which the instrument is capable, replacement should be followed by calibration of the affected circuits. Table 5-3 lists the assemblies which affect calibration and the adjustment needed.

Table 5-1. PHASE-LOCKED LOOP RF-SIGNAL LEVELS

P.L.L.	MODULE	INPUT-SIGNAL FREQUENCY	INPUT-SIGNAL LEVEL dBm (mV)	MEASURED AT
1	M31A	1 kHz	TTL	M30-1/4 (W13)
2	M32A	1 MHz	TTL	M30-1/4 (W12)
		1440 MHz	-12 to -15 dBm (20 mV)	M30-1/4 (W9)
3 & 5	M33-2	1198 MHz	-10 dBm ±3 dB (150 m V)	M9W (W5)
		1200 MHz (120 comb)	-15 dBm ±5 dB (75 mV)	M30-1/4 (W10)
		2 kHz	TTL	M30-1/4 (W11)
		1.9 to 2.1 MHz	1 volt pp	M29-1 (W7)
4	M34	1198 to 1718 MHz	-10 dBm ±5 dB (25 mV)	M9W (W4)
		1448 to 1487 MHz	-2 dBm ±3 dB (200 mV)	M32A (W8)
		40 to 280 MHz (40 comb)	-10 dBm ±3 dB (1 V)	M30-1/4 (W6)
		10 to 9.001 MHz	TTL	M31A (W14)



TTL LOGIC LEVEL

Table 5-2. BCD FREQUENCY SWITCHES

Decimal Digit	BCD Wires 8 4 2 1
0	- - - -
1	- - - 0
2	- - 0 -
3	- - 0 0
4	- 0 - -
5	- 0 - 0
6	- 0 0 -
7	- 0 0 0
8	0 - - -
9	0 - - 0

NOTE: 0 = Wire Grounded by Switch.
— = Wire NOT Grounded.

TABLE 5-3. ASSEMBLY REPLACEMENT CALIBRATION

ASSEMBLY REPLACED	ADJUSTMENT/CHECK REQUIRED (See indicated sections in Calibration Procedure)
B006 Meter Board	Meter Board (5.3.10, 5.3.15, and 5.3.18)
C316-7 Modulation Board	PLL 5 (5.3.9)
DPS2A Power Supply	±18 V and 7.3 V (5.3.1 through 5.3.3)
M9W Sweep Oscillator	PLL 4 and 3 (5.3.7 and 5.3.8)
M10W-17 Output Amplifier	Meter Board (5.3.10)
M29-2 FM Reference	PLL 5 (5.3.9)
M30-9 Crystal Reference	Frequency (5.3.4 and 5.3.13)
M31A kHz Steps	None required
M32A MHz Steps	PLL 2 (5.3.6)
M33-2 Narrow Osc. Lock	PLL 3 (5.3.8)
M34 Wide Osc. Lock	M34 Leveler (5.3.7)
M35-2 RF Circuit Breaker	Check RF Protection
M43 Amplifier/Mixer	None required
M44-1 FM Discriminator	Gain (5.3.17)
M115 Down Converter	Gain (5.3.11)
M172 Sweep Drive/DAC	PLL 4 (5.3.8)
2 MHz Offset Board	None required

6.1 INTRODUCTION

This section contains lists of all replaceable parts for the instrument.

For an assembly containing one or more subassemblies, the assembly list appears first, and is followed by the subassembly lists.

The lists appear in the following order.

Signal Generator, 3007	1010-00-0224
Chassis, 3007	1111-00-0156
Chassis Plate, 3007	1216-00-0151
Front Panel Assy, 3007	1216-00-0145
PWR SW Assy	1212-00-0006
Harness, 3000-200-FP	1219-00-0108
Harness, 3000-200-SW	1219-00-0102
Modulation Board, C316-7	1110-00-0687
Mod Bd Sub Assy	1218-00-0682
Meter Board, B006	1110-00-0741
Meter Bd Sub Assy	1218-00-0760
Offset Board, 3007	1110-00-1010
RF Circuit Breaker, M35-2	1114-00-0225
Mech, B, M35-2	1216-00-0094
Power Supply, DPS2A	1115-00-0034
PC Assy	1218-00-0252
Line Cord Assy	1219-00-0144
Transformer Assy	1219-00-0421
RF Amp/Mixer, M43	1114-00-0443
Mech, L, M43	1216-00-0117
Mech, B, M43	1216-00-0115
Crystal Reference, M30-9	1114-00-0450
PC Assy	1218-00-0192
Mech, L, M30-9	1216-00-0149
Mech, B, M30	1216-00-0061
Output Amp, M10W-17	1114-00-0451
Amplifier Board Assy	1218-00-0601
Leveler Board Assy	1218-00-0611
Mech, L, M10W-17	1216-00-0148
Mech, B, M10W-17	1216-00-0146

FM Discriminator, M44-1	1114-00-0452
PC Assy	1218-00-1561
Mech, B, M44	1216-00-0112
Narrow Oscillator Lock, M33-2	1114-00-0462
Mech, L, M33-2	1216-00-0089
Mech, B, M33-2	1216-00-0090
Down Converter, M115	1114-00-0463
PC Assy, F	1218-00-1451
PC Assy, R	1218-00-1461
Mech, L, M115	1216-00-0092
Mech, B, M115	1216-00-0093
FM Reference, M29-2	1114-00-0464
PC Assy	1218-00-1690
Mech, B, M29-2	1216-00-0045
kHz Steps, M31A	1114-00-0465
PC Assy	1218-00-1700
Mech, B, M31	1216-00-0046
Sweep Oscillator, M9W	1114-00-0466
Mixer Assy	1219-00-0423
Pre-Amp Assy	1219-00-0424
Mech, L, M9W	1216-00-0048
Mech, B, M9W	1216-00-0049
MHz Steps, M32A	1114-00-0469
Oscillator Control Bd Assy	1218-00-0027
Digital Program Bd Assy	1218-00-0028
Mixer Assy	1219-00-0426
Video Amp Assy	1219-00-0440
Mech, L, M32	1216-00-0057
Mech, B, M32	1216-00-0058
DAC/Sweep Drive, M172	1114-00-0473
PC Assy	1218-00-1670
Mech, B, M172	1216-00-0047
Wide Oscillator Lock, M34	1114-00-0477
Leveler Assy	1218-00-0314
Phase-Lock Assy	1218-00-0334
Mixer/Amp Assy	1219-00-0429
Video Mixer Assy	1219-00-0430
Video Amp Assy	1219-00-0431
Mech, L, M34	1216-00-0054
Mech, B, M34	1216-00-0055
Cable Kit, 3007	1219-00-0542

6.2 MANUFACTURERS CODE

The following code is used on the parts lists to identify the manufacturer.

ABBRV	NAME	CITY	ST
A-B	ALLEN-BRADLEY	MILWAUKEE	WI
A-D	ANALOG DEVICES	CAMBRIDGE	MA
A-H	ARROW HART, INC.	KETTERING	OH
A-I	ALAN INDUSTRIES	COLUMBUS	IN
A-M	AMERICAN MAGNETICS	CARTERVILLE	IL
A-P	AMERICAN PLASTICRAFT CO.	CHICAGO	IL
ABAC	ABACUS PACKAGING CO.	CHICAGO	IL
ACEIN	ACE INDUSTRIAL HDWR.	CAMDEN	NJ
ACI	ADVANCE COMPONENTS, INC.	CENTERBROOK	CT
AEG-T	AEG-TELEFUREN CORP.	SOMERVILLE	NJ
AER	AVX CERAMICS	MYRTLE BEACH	SC
AERTK	AERTECH INDUSTRIES	SUNNYVALE	CA
AHAM	AHAM COMPANY	AZUSA	CA
AIN	ALPHA INDUSTRIES, INC.	WOBURN	MA
ALC	ALCO ELECTRONICS PRODUCTS	NORTH ANDOVER	ME
ALLPL	ALL PLASTICS, INC.	INDIANAPOLIS	IN
AMD	ADVANCED MICRO DEVICES INC.	SUNNYVALE	CA
AMELC	AMERICAN ELECTRIC CORDSETS	BENSENVILLE	IL
AMP	AMP, INC.	HARRISBURG	PA
ANZAC	ADAMS-RUSSELL,ANZAC DIV	BURLINGTON	MA
APL	AMPHENOL CONNECTOR SYSTEMS	BROADVIEW	IL
APP	A-P PRODUCTS	PAINESVILLE	OH
APX	AMPEREX ELECTRONIC CORP.	SLATERSVILLE	RI
ARC	ARCO ELECTRIC PRODUCTS	SHELBYVILLE	IN
ARN	ARNOLD ENGINEERING CO.	MARENGO	IL
ARW-M	ARROW-M CORP.	CARSON	CA
ASC	ASSOCIATED SPRING	BRISTOL	CT
ASE	AIRCO SPEER ELECTRONICS	ST. MARYS	PA
ASTID	ASTRO INDUSTRIES	DAYTON	OH
AT/IN	ATLANTIC INDIA RUBBER COMPANY	CHICAGO	IL
ATC	AMERICAN TECHNICAL CERAMICS	HUNTINGTON STATION	NY
ATR	ATR COIL CO.	BLOOMINGTON	IN
AUGAT	AUGAT, INC.	ATTLEBORO	MA
AULT	AULT INC.	MINNEAPOLIS	MN
AUTCP	AUTOMATION CORP.	PECKVILLE	PA
AVDEL	AVDEL FASTENER SYS.	PARSIPPANY	NJ
AVT	AVANTEK, INC.	SANTA CLARA	CA
AWC	ALPHA WIRE	ELIZABETH	NJ
B-T	BEK-TEK, INC.	READING	PA
BEARI	BEARINGS, INC.	CLEVELAND	OH
BEK	BECKMAN INSTRUMENTS, INC.	FULLERTON	CA
BEL	BELDEN CORP.	GENEVA	IL
BER	BERG ELECTRONICS	NEW CUMBERLAND	PA
BGH	BEECH GROVE HARDWARE	BEECH GROVE	IN
BORDN	BORDEN INC.	COLUMBUS	OH
BOU	BOURNS, INC.	RIVERSIDE	CA
BREZ	BREEZE CORPORATIONS, INC.	UNION	NJ
BSCAN	B-SCAN, INC.	PHILADELPHIA	PA
BUCK	BUCKEYE STAMPING CO.	COLUMBUS	OH
BUD	BUD RADIO, INC.	WILLOUGHBY	OH
BURND	BURNDY CORP.	NORWALK	CT
BUS	BUSSMAN MFG.	ST. LOUIS	MO
BWC	BARON WIRE AND CABLE CORP.	NILES	IL
C-D	CORNELL DUBILIER ELECT. DIV.	NEWARK	NJ
C-E	CLINTON ELECTRONICS	ROCKFORD	IL
C-H	CUTLER-HAMMER, INC.	MILWAUKEE	WI
C-I	COMPONENTS, INC.	BIDDEFORD	ME
C-J	TRW/CINCH	ELK GROVE VILLAGE	IL
C-K	C & K COMPONENTS, INC.	WATERTOWN	MA
C-L	CENTRALAB DIV.	MILWAUKEE	WI
C M	C-M		
C-W	C-W INDUSTRIES	WARMINSTER	PA
CAI	CUSTOM ACCESSORIES, INC.	SKOKIE	IL
CAM	CAMBION	CAMBRIDGE	MA
CAR	CARLING ELECTRIC, INC.	WEST HARTFORD	CT
CCM	CORCOM, INC.	CHICAGO	IL
CDC	COMPONENT DEVELOPMENT CORP.	CARSON	CA
CECO	CENTRAL COIL CO.	BRAZIL	IN
CFI	CIRCUIT FUNCTIONS INC.	NEWBURY PK	CA
CGW	CORNING GLASS WORKS	CORNING	NY
CHE	CHERRY ELECTRICAL PRODUCTS	WAUKEGAN	IL
CHEMP	CHEMPLAST,INC.	WAYNE	NJ
CHLAR	CHARLES LARSON CO.	STERLING	IL
CHOM	CHOMERICS INC.	WOBURN	MA
CHRY	CHRYSLER CORP.	DETROIT	MI
CIMCO	CIMCO WIRE AND CABLE INC.	ALLENDALE	NJ

ABBRV	NAME	CITY	ST
CKI	CTS KNIGHTS, INC.	SANDWICH	IL
CLA	CLAIREX CORP.	MT. VERNON	NY
CLAR	CLAROSTAT MFG. CO	DOVER	NH
CLFRM	COILFORM	GENEVA	IL
CLFX	COLE-FLEX CORP.	BABYLON	NY
CNCRD	CONCORD ELEX	NEW YORK	NY
CPKG	CREATIVE PACKAGING DIV.	INDIANAPOLIS	IN
CPLRD	COMPLETE READING		
CRTR	CORE-TRONICS	ORANGE	NJ
CTS	CHICAGO TELEPHONE SYSTEMS	CHICAGO	IL
CTS-E	CTS OF ELKHART	ELKHART	IN
CTS-F	C.T.S. OF FAIRBERRY	FAIRBERRY	IL
CTS-K	CTS OF KEENE	PASO ROBLES	CA
CTSBR	CTS OF BERNE	BERNE	IN
CTSBV	CTS OF BROWNSVILLE	BROWNSVILLE	TX
CW/AL	C.W./ALPHA	SOUTHAMPTON	PA
DAL	DALE TECHNOLOGY CORP.	HARTSDALE	NY
DATEL	DATEL SYSTEMS, INC.	MANSFIELD	MA
DAV	HARRY DAVIES MOLDING CO.	CHICAGO	IL
DAYTN	DAYTON ELECTRIC CO.	CHICAGO	IL
DEL	DELEVAN DIV.	EAST AURORA	NY
DEN	DENNISON MFG. CO.	FRAMINGHAM	MA
DEW	DEWIRE FABRICATING CORP.	LOWELL	MA
DILEC	DILECTRON	MONROVIA	CA
DIO	DIODES, INC.	CHATSWORTH	CA
DK-WR	DAKO-WARE	CHICAGO	IL
DLGHT	DIALIGHT	BROOKLYN	NY
DNTCH	DONTECH, INC.		
DRA	DRAKE MANUFACTURING CO.	HARWOOD HEIGHTS	IL
DRMYR	DORMEYER	ROCKVILLE	IN
DYNR	DYNEER CORP.	CHATSWORTH	CA
E-C	ELECTRONIC CRYSTALS	KANSAS CITY	MO
E-I	ELECTRICAL INDUSTRIES, INC.	MURRAY HILL	NJ
E-M	ELECTRA/MIDLAND CORP.	MINERAL WELLS	TX
EBY	EBY COMPANY	PHILADELPHIA	PA
ECKDT	ECKARDT LABORATORIES	ORANGE	CA
ECMC	ELECTRI-CORD MFG. CO. INC.	WESTFIELD	PA
ELC-I	ELECTRA	CUMBERLAND	IN
ELCO	ELCO INDUSTRIES	ROCKFORD	IL
ELEXP	ELECT EXPEDITERS	MILWAUKEE	WI
ELFX	ELECTRO-FLEX HEAT INC.	BLOOMFIELD	CT
ELHDW	ELECTRONIC HARD	FARMINGDALE	NY
ELNA	ELNA	CARSON	CA
EMRON			S
EPITK	EPITEK ELECTRONICS	KANATA, ONT., CAN.	**
EPOXT	EPOXY TECHNOLOGY, INC.	BILLERICA	MA
ETC	ELECTRONIC TRANSISTOR CORP.	FLUSHING	NY
ETP	ERIE TECHNOLOGICAL PRODUCTS	ERIE	PA
EVRDY	EVEREADY	NEW YORK	NY
EXAR	EXAR INTEGRATED SYSTEMS	SUNNYVALE	CA
EZLOK	E-Z LOK	GARDENIA	CA
F-K	THERMWELL PRODUCTS, INC.	FRAMINGHAM	MA
F-S	FEDERAL SCREW	CHICAGO	IL
FAN	FANCOURT & CO.	GREENSBORO	NC
FASTX	FASTEX DIV., ILL. TOOL WORKS	DES PLAINES	IL
FCD	FAIRCHILD	MOUNTAIN VIEW	CA
FNWL	FENWAL	FRAMINGHAM	MA
FRK	FRAKO	FRANKFORT, GER.	**
FRTE	FAIR RITE PRODUCTS CORP.	WALLKILL	NY
FRXC	FERROXCUBE DIVISION	SAUGERTIES	NY
G-E	GENERAL ELECTRIC	INDIANAPOLIS	IN
G-H	GRAYHILL, INC.	LA GRANGE	IL
G-I	GEN'L INSTRUMENT SEMICONDUCTOR	HICKSVILLE	NY
G-T	GRAND TRANSFORMERS	GRAND HAVEN	MI
GAL	GALILEO ELECTRO-OPTICS	CARMEL	IN
GATES	GATES ENERGY PROD.	DENVER	CO
GBN	GILBERT ENGINEERING CO. INC.	PHOENIX	AZ
GCE	GC ELECTRONICS	ROCKFORD	IL
GHZ	GHZ DEVICES, INC.	CHELMSFORD	MA
GLOBE	GLOBE	MILWAUKEE	WI
GNATR	GENERAL ATRONICS CORP.	PHILADELPHIA	PA
GOU	GOULD, INC.	ST. PAUL	MN
GRIES	GRIES REPRODUCER	NEW ROCHELLE	NY
GRIP	GRIPMASTER CO.	MARLBORO	NJ
GRVCO	GROVE COMPANY	DAYTON	OH
GUDL	GUDEBROD BROS. SILK CO.	CHICAGO	IL

ABBRV	NAME	CITY	ST
H-P	HEWLETT-PACKARD	INDIANAPOLIS	IN
HARTW	HARTWELL CORP.	PLACENTIA	CA
HEL	HELIPOT	ANAHEIM	CA
HEY	HEYMAN MFG. CO.	WAUKESHA	WI
HHS	HERMAN H. SMITH, INC.	BROOKLYN	NY
HI-G	HI-G INC.	WINDSOR LOCKS	CT
HI-G	HI-G INC	WINDSOR LOCKS	CT
HIT	HITACHI AMERICA, LTD.	SAN FRANCISCO	CA
HMLN	HAMLIN	LAKE MILLS	WI
HOLGW	HOLLINGSWORTH SLDRLS TERM.	POTTSTOWN	PA
HOLUB	HOLUB DISTRIBUTING CO.	NEWPORT	KY
HSD	HARRIS CORP. SEMICDR. DIV.	MELBOURNE	FL
HUD	HUDSON TOOL & DIE CO.	NEWARK	NJ
HY/PL	HYDRO PLASTICS INC.	GEORGETOWN	KY
HYSYS	HYBRID SYSTEMS	BEDFORD	MA
HYT	HYTRONICS	PINELLAS PARK	FL
ICI	ILLINOIS CAPACITOR INC.	MORTON GROVE	IL
ICO-R	ICO-RALLY	PALO ALTO	CA
IERC	INT'L ELEC. RESEARCH CORP.	BURBANK	CA
INDCP	INDUCTIVE COMPONENTS	HAUPPAUGE	NY
INDEC	INDUSTRIAL ELECTRONIC HDWR.	NEW YORK	NY
INLOK	INTERLOK/WM J PURDY CO.	BURLINGAME	CA
INT	INTERSIL, INC.	CUPERTINO	CA
INWEB	INTERNATIONAL WEBBING	WHITEHALL	PA
IRC	INTERNATIONAL RESISTANCE CO.	PHILADELPHIA	PA
IREC	INT'L RECTIFIER CORP.	LOS ANGELES	CA
ITRON	ISE ELECTRONICS	ISE, JAPAN	**
ITT	INT'L TELEPHONE & TELEGRAPH	W. PALM BEACH	FL
JAMES	JAMES ELECTRONICS	CHICAGO	IL
JAN	JAN HARDWARE MFG. CO.	LONG ISLAND CITY	NY
JEF	JEFFERS	DUBOIS	PA
JEFWC	JEFFERSON WIRE AND CABLE	WORCHESTER	MA
JEW	JEWELL ELECTRICAL INSTRUMENTS	MANCHESTER	NH
JFD	JFD ELECTRONICS	BROOKLYN	NY
JFW	JFW INDUSTRIES	BEECH GROVE	IN
JHSN	JOHANSON MFG. CORP.	BOONTON	NJ
JON	E.F. JOHNSON CO.	WASECA	MN
JUDD	JUDD WIRE DIV. ECC	TURNERS FALLS	MA
K-L	KERRIGAN LEWIS MFG.	CHICAGO	IL
K-S	K & S ENGINEERING CO.	CHICAGO	IL
KDI-P	KDI-PYROFILM CORP.	WHIPPANY	NJ
KEENE	KEENE CORP.	NEWARK	DE
KEM	KEMTRON ELECTRON PRODUCTS	NEWBURYPORT	MA
KEY	KEYSTONE ELECTRONIC CORP.	NEW YORK	NY
KID	KIDCO, INC.	MEDFORD	NJ
KIN	KINGS ELECTRONICS	TUCKAHOE	NY
KMYO	KAMAYA OHM	JAPAN	**
KRYST	KRYSTINEL	PATERSON	NJ
KSTR	KESTER SOLDER DIV.	CHICAGO	IL
KSW	KSW ELECTRONICS	BURLINGTON	MA
KSW	KSW ELECTRONICS	BURLINGTON	MA
KUL	KULKA ELECTRIC CORP.	MT. VERNON	NY
LAURN	LAUREN MFG CO.	NEW PHILADELPHIA	OH
LEYSE	LEYSE ALUMINUM CO.	KEWANEE	WI
LIT	LITTELFUSE, INC.	DES PLAINES	IL
LNMST	LINEMASTER SWITCH CORP.	WOODSTOCK	CT
LOCTT	LOCTITE CORP.	NEWINGTON	CT
LRC	LRC ELECTRONICS, INC.	HORNELL	NY
LTRNX	LITRONIX	CUPERTINO	CA
M-A	MICROWAVE ASSOCIATES	BURLINGTON	MA
M-D	MILLER DIAL & NAMEPLATE CO.	EL MONTE	CA
M-E	MEPCO ELECTRA, INC.	MORRISTOWN	NJ
M-O	ILLUMINATED PRODUCTS INC.	SANTA ANA	CA
M-P	MICRO PLASTICS INC.	CHATSWORTH	CA
MAL	MALLORY CONTROLS CO.	FRANKFORT	IN
MAND	MANDEX	CHICAGO	IL
MARQ	J. & J. MARQUARDT	TUTTLINGEN, GER.	**
MCREL	MICRO ELEX LTD	HONG KONG	**
MD-AM	MID AMERICA	CHICAGO	IL
MDC	MAIDA DEVELOPMENT CO.	HAMPTON	VA
MDLRS	MIDLAND ROSS	CINCINNATI	OH
MDTC	MODUTEC	NORWALK	CT
MILN	MILLEN MFG. CO.	NEW YORK	NY
MILSP	MILITARY SPECIFICATION	WASHINGTON	DC
MIN-C	MINI-CIRCUITS	BROOKLYN	NY
MINIS	MINI SYSTEMS	NORTH ATTLEBORO	MA

ABBRV	NAME.....	CITY.....	ST
MINOR	MINOR RUBBER CO.	BLOOMFIELD	NJ
MITEK	MITEK	LEXINGTON	MA
MLRJW	J.W. MILLER	COMPTON	CA
MMM	3M COMPANY	ST. PAUL	MN
MNO	MONSANTO COMM. PROD. DIV.	PALO ALTO	CA
MOL	MOLEX PRODUCTS	LISLE	IL
MORAD	MORGAN ADHESIVES	STOW	OH
MOSTK	MOSTK CORP.	CARROLLTON	TX
MOT	MOTOROLA SEMI. PROD. DIV.	INDIANAPOLIS	IN
MRM	M. ROSS MASON	INDIANAPOLIS	IN
MRO	MICRO SWITCH DIV.	FREEPORT	IL
MRRUB	MARION RUBBER PROD.	INDIANAPOLIS	IN
MSN	MICROSONICS DIV.	WEYMOUTH	MA
MSP	MICRO SEMICONDUCTOR CORP.	SANTA ANA	CA
MULSO	MULTICORE SOLDERS LTD.	WESTBURY	NY
MURA	MURA		
MURA	MURA	WESTBURY	NY
MURGA	MURATA-GEORGIA	MARIETTA	GA
MWS	MAGNET WIRE SUPPLY CO.	CHATSWORTH	CA
MYERS	MYERS SPRING CO.	LOGANSPORT	IN
N-T	NATIONAL TEL-TRONICS	LAREDO	TX
NAT	NATIONAL SEMICONDUCTOR CORP.	SANTA CLARA	CA
NCC	NATIONAL CERAMIC CO	TRENTON	NJ
NCSVC	NATL COM SERV.	WILLOW GROVE	PA
NEC	NIPPON ELECTRIC CO.	TOKYO, JAPAN	**
NEL	NATIONAL ENGINEERING LABS	INDIANAPOLIS	IN
NEW	NEWARK ELECTRONICS	INDIANAPOLIS	IN
NHWC	NEW HAVEN WIRE & CABLE	NEW HAVEN	IN
NICHN	NICHICON (AMERICA) CORP.	SCHAUMBURG	IL
NMB	NMB CORP.	ARLINGTON HEIGHTS	IL
NMC	MAGNUM MICROWAVE CORP.	SUNNYVALE	CA
NPC	NUCLEONIC PRODUCTS CO.	CANOGA PARK	CA
NYLO	NYLOMATIC	MORRISVILLE	PA
O-G	OPTI-GAGE INC.	DAYTON	OH
O-S	OMNI SPECTRA INC.	FARMINGTON	MI
OAK	OAK INDUSTRIES INC.	CRYSTAL LAKE	IL
OHM	OHMITE MFG. CO.	SKOKIE	IL
OMEGA	OMEGA WIRE & CABLE	HARLEYSVILLE	PA
OPTRN	OPTRON INC.	CARROLLTON	TX
P-B	POTTER AND BRUMFIELD	PRINCETON	IN
P-C	POWER COMPONENTS	WOODLAND HILLS	CA
P-K	PARKER KALON CORP.	CLIFTON	NJ
P-T	PENN TUBE PLASTICS CO.	CLIFTON HEIGHTS	PA
P-U	PROJECTS UNLIMITED INC.	DAYTON	OH
POLPH	POLYPHASE INSTR. CO.	BRIDGEPORT	PA
PACTC	PACTEC DIV.	PHILADELPHIA	PA
PAM	PAMOTOR DIV.	BURLINGAME	CA
PAND	PANDUIT CORP.	TINLEY PARK	IL
PARA	PARAMETRIC INDUSTRIES	NORTHFIELD	IL
PCC	PANEL COMPONENTS CORP.	BERKELEY	CA
PEC	PACIFIC ELECTRICORD CO.	GARDENA	CA
PEM	PENN ENGRG & MANUF CO.	DANBORO	PA
PFZR	PFIZER. NC.		
PHC	PHILADELPHIA HANDLE CO.	CAMDEN	NJ
PHILP	PHILPOTT RUBBER CO.	CLEVELAND	OH
PIC	PIHER INTERNATIONAL CORP.	ARLINGTON HEIGHTS	IL
PLI	PRECISION LAMP, INC.	MT. VIEW	CA
PLSSY	PLESSEY ENG.	SCHILLER PARK	IL
PLSTI	PLASTIC TECHNIQUES, INC	NEW BOSTON	NH
PLYCL	POLYCLAD LAMINATES	SOUTHFIELD	MI
PMCL	PERMACEL DIV.	NEW BRUNSWICK	NJ
PMI	PRECISION MONOLITHICS INC.	SANTA CLARA	CA
PNSNC	PANASONIC		
POM	POMONA ELECTRONICS CO., INC.	POMONA	CA
PREH	PREH VERT,MBH	GERMANY	**
PRMD	PYRAMID INDUSTRIES, INC.	PHOENIX	AZ
PRSLK	PRESTO-LOCK	GARFIELD	NJ
PRSN	PRECISION TUBE CO., INC	NORTH WALES	PA
PTN	PENN TRAN CORP.	BELLEFONT	PA
PWRMT	POWER-MATE CORP.	HACKENSACK	NJ
PYRO	PYROFILM CORP.	WHIPPANY	NY
PYTT	PYTTRONICS INDUSTRIES, INC.	MONTGOMERYVILLE	PA
Q-C	QUALITY COMPONENTS	ST. MARYS	PA
R-N	ROBINSON-NUGENT	NEW ALBANY	IN
R-OHM	R-OHM	IRVINE	CA
RAWST	RAW STOCK	*****	**

ABBRV	NAME.....	CITY.....	ST
RAY	RAYTHEON	INDIANAPOLIS	IN
RCA	RCA	CAMDEN	NJ
REL	RELIANCE MICA CO.	BROOKLYN	NY
RGNCY	REGENCY ELECTRONICS, INC.	INDPLS.	IN
RGR	ROGERS CORP.	CHANDLER	AZ
RICH	RICHCO PLASTIC CO.	CHICAGO	IL
RICHM	RICHARDS METAL PRODUCTS	WOLCOTT	CT
RMC	RADIO MATERIALS CORP.	CHICAGO	IL
RMF	RMF PRODUCTS INC.	BATAVIA	IL
ROCKW	ROCKWELL INTL.	ANAHEIM	CA
ROGAN	ROGAN CORP.	NORTHBROOK	IL
ROTRN	ROTRON INC.	WOODSTOCK	NY
RPBLC	REPUBLIC ELECTRONICS CORP	PATTERSON	NJ
RSSLL	RUSSELL	OCEANSIDE	NY
S-C	SPECIALTY CONNECTOR	INDIANAPOLIS	IN
S-G	STANDARD GRIGSBY	AURORA	IL
S-I	SWITCHCRAFT, INC.	CHICAGO	IL
S-S	SERVICE SUPPLY	INDIANAPOLIS	IN
S-T	SARKES TARZIAN	BLOOMINGTON	IN
SAGE	SAGE LABORATORIES, INC.	NATIC	MA
SAYRO	SAYROSA ENGINEERS LTD.	ALTON, HANTS, U.K.	**
SCBE	SCANBE DIVISION	EL MONTE	CA
SCC	STACKPOLE CARBON CO.	ST. MARYS	PA
SCX	SILICONIX INC.	SANTA CLARA	CA
SEAST	SEASTROM MFG. CO.	GLENDALE	CA
SECR	SECOR INC.	WESTWOOD	NJ
SEL	SEALECTRO CORP.	MAMARONECK	NY
SEM	SEMTECH	NEWBURY PARK	CA
SEMTX	SEMTEX	DAYTON	OH
SGM	SIGMA INSTRUMENTS	BRAINTREE	MA
SGS-A	SGS-ATES COMP ELET SPA	AGRATE BRIANZE, ITALY	**
SHAM	SHAMROCK PLASTICS & RUBBER CO.	INDIANAPOLIS	IN
SHDW	I.E.E. SCHADOW	EDEN PRAIRIE	MN
SHKMN	SHACKMAN INSTRUMENTS	CHESHAM, ENGLAND	**
SIEM	SIEMENS	ISELIN	NJ
SIG	SIGNETICS CORPORATION	SUNNYVALE	CA
SIGPT	SIGMA PLASTRONICS	DEARBORN	MI
SINCR	SINCLAIR & RUSH, INC.	ST. LOUIS	MO
SKDRV	STOCK DRIVE PROD. DIV.	NEW HYDE PARK	NY
SLT	SOLITRON/MICROWAVE DIV.	PORT SALERNO	FL
SMTC	SAMTEC INC.	NEW ALBANY	IN
SOUTH	SOUTHCO FASTENERS	LESTER	PA
SPE	SPECTROL	DAYTON	OH
SPEC	SPECTRUM CONTROL, INC.	FAIRVIEW	PA
SPR	SPRAGUE ELECTRIC CO.	INDIANAPOLIS	IN
SPRTX	SUPERTEX INC.	CUPERTINO	CA
SPST	SPECTRA-STRIP	GARDEN GROVE	CA
SSS	SOLID STATE SCIENTIFIC	MONTGOMERYVILLE	PA
STDPS	STANDARD PRESSED STEEL	JENKINTOWN	PA
STKFS	STAKE FASTENERS	SOUTH EL MONTE	CA
STR	STETTNER TRUSH CO.	CAZENOVIA	NY
STSA	STEEL SALES	INDIANAPOLIS	IN
SYL	GTE SYLVANIA	WALTHAM	MA
SYNTC	SYNTAC CORP.	CLEVELAND	OH
SYNTX	SYNERTEK	**	*
SYS	SYSCON INTERNATIONAL, INC.	SOUTH BEND	IN
T-I	TEXAS INSTRUMENTS	DALLAS	TX
TCPL	TACONIC PLASTIC	PETERSBURG	NY
TEK	TEKTRONIX	INDIANAPOLIS	IN
TEKA	TEKA PRODUCTS INC.	COLLEGE POINT	NY
TEKNT	TECKNIT	CRANFORD	NJ
TELE	TELETYPE CORP.	ELK GROVE VILLAGE	IL
TELRY	TELEDYNE RELAYS	HAWTHORNE	CA
TFI	T&F INDUSTRIES DIV.	ROLLING MEADOWS	IL
THR	THERMALLOY CO.	DALLAS	TX
TIMES	TIMES WIRE AND CABLE	CINCINNAI	OH
TIN	TINNERMAN PRODUCTS, INC.	CLEVELAND	OH
TKN	TECHNICAL WIRE	CRAWFORD	NJ
TLNC	TELONIC ALTAIR	LAGUNA BEACH	CA
TOKO	TOKO AMERICA	SKOKIE	IL
TOKO	TOKO AMERICA	SKOKIE	IL
TORCO	TOR CORP.	VAN NUYS	CA
TR-UT	TRIAD-UTRAD DIV.	HUNTINGTON	IN
TRIYX	TRIONYX INDUSTRIES	INDIANAPOLIS	IN
TRU	WALDES TRUARC	LONG ISLAND CITY	NY

ABBRV	NAME.....	CITY.....	ST
TRW	TRW CAPACITOR DIV.	OGALLALA	NB
TSHBA	TOSHIBA	**	*
TVL	TEL-VISION LABS	WAUCONDA	IL
TWAY	TWAY COMPANY	INDIANAPOLIS	IN
TYTON	TYTON CORP.	MILWAUKEE	WI
U-C	UNIVERSAL COMPONENTS	LOS ANGELES	CA
ULSP	UNDERWRITERS LAB. SPEC.	CHICAGO	IL
UNCAR	UNION CARBIDE COMPONENTS	GREENVILLE	SC
UNIC	UNICORP	ORANGE	NJ
UNIT	UNITRODE CORP.	WATERTOWN	MA
USECO	USECO DIV.	VAN NUYS	CA
UTK	UNITRACK DIV.	UPPER DARBY	PA
VAC	VACTEC INC.	MARYLAND HEIGHTS	MO
VACO	VACO PRODUCTS CO.	NORTHBROOK	IL
VAR	VARADYNE CAPACITOR DIV.	SANTA MONICA	CA
VARIL	VARI-L CO.	DENVER	CO
VELCR	VELCRO USA INC	NEW YORK	NY
VISCM	VISUAL COMM		
VLIER	VLIER ENGINEERING CORP.	BURBANK	CA
VONGT	VONNEGUT HARDWARE	INDIANAPOLIS	IN
VRN	VERNITRON CORP.	GREAT NECK	NY
VTRMN	VITRAMON, INC.	BRIDGEPORT	CT
W-E	WELLS ELECTRONICS	SOUTH BEND	IN
W-I	WAVETEK INDIANA, INC.	BEECH GROVE	IN
WAG	WAGNER ELECTRIC CORP.	ST. LOUIS	MO
WECK	WECKESSER CO., INC.	CHICAGO	IL
WHTMN	WHITMAN	CINCINNATI	OH
WKFLD	WAKEFIELD ENGINEERING	WAKEFIELD	MA
WLDM	WALDOM	CHICAGO	IL
WMBG	W.M. BERG	ROCKAWAY	NY
WNSL	WEINSCHEL ENGINEERING	GAITHERSBURG	MD
WNZLR	WINZLER MFG	CHICAGO	IL
WSD	WAVETEK	SAN DIEGO	CA
WSTN	WESTON COMPONENTS	ARCHBALD	PA
ZEN	ZENITH RADIO CORP.	CHICAGO	IL
ZERO	ZERO MANUFACTURING CO.	BURBANK	CA
ZIE	ZIERICK MFG. CORP.	MOUNT KISCO	NY
ZPT	ZIPPERTUBING, CO.	LOS ANGELES	CA

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	CHASSIS,3007	3007-CHAS	W-I	1111-00-0156	1.000
A08	XTAL REF,M30-9	M30-9	W-I	1114-00-0450	1.000
A09	RF CKT BKR,M35-2	M35-2	W-I	1114-00-0225	1.000
A11	FM DSCRMNTR,M44-1	M44-1	W-I	1114-00-0452	1.000
A12	DOWN-CVTR,M115	M115	W-I	1114-00-0463	1.000
A15	SWP DRV/DAC,M172	M172	W-I	1114-00-0473	1.000
F220V	FUSE,S.B.,.5 AMP MF000-007	MDL 1/2	BUS	2410-05-0004	1.000
ZA03	SWP OSC,M9W	M9W	W-I	1114-00-0466	1.000
ZA06	FM REF,M29-2	M29-2	W-I	1114-00-0464	1.000
ZA08	KHZ STEPS,M31A	M31A	W-I	1114-00-0465	1.000
ZA09	MHZ STEPS,M32A	M32A	W-I	1114-00-0469	1.000
ZA10	NARROW OSC LK,M33-2	M33-2	W-I	1114-00-0462	1.000
ZA11	WIDE OSC LK,M34	M34	W-I	1114-00-0477	1.000
ZA13	RF AMP/MXR,M43	M43	W-I	1114-00-0443	1.000

WAVETEK PARTS LIST	SGL GEN,3007	1010-00-0224 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	ETI HOLDER,.75 DIA	T-102	FRDKS	2410-99-0007	1.000
A03	CHAS PLATE,3007	3007-CHAS PLATE	W-I	1216-00-0151	1.000
A04	OFFSET BOARD,3007	3007-OFFSET BD	W-I	1110-00-1010	1.000
AT01	ATTEN,50130-01	50130-01	W-I	1113-30-0060	1.000
BT101	PS MDL FOR ET,12V	T-200-14	FRDKS	2410-99-0008	1.000
M101	ETI CELL, 5000 HR	T-000-4	FRDKS	2410-99-0006	1.000
PS01	PWR SUPPLY,DPS2A	DPS2A	W-I	1115-00-0034	1.000

WAVETEK PARTS LIST	CHASSIS,3007	1111-00-0156 PAGE: 1	D REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	CHAS TRAY,3007	3007-CHAS TRAY	W-I	1216-00-0152	1.000
HH01	HARNESS,3007	WY3007	W-I	1219-00-0471	1.000

WAVETEK PARTS LIST	CHAS PLATE,3007	1216-00-0151 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A03	MOD BD,C316-7	C316-7	W-I	1110-00-0687	1.000
CR01	LED,GN,T-1-3/4	HLMP-3507	H-P	4810-02-0003	1.000
CR02 CR05 CR06	LED,RED,T-1-3/4	MSL5046	NAT	4810-02-0001	3.000
DEL	LED MTG CLIP/RING	HLMP-0103	H-P	2810-11-0022	1.000
HH02	HRNSS,3000-200-LED2	WY3000-200-C	W-I	1219-00-0305	1.000
HH03	HARNESS,3000-200-SW	WYB006	W-I	1219-00-0102	1.000
HH04	HARNESS,3000-200-FP	WYB006-A	W-I	1219-00-0108	1.000
J112	CONN,BNC-F,50,PANEL UG-1094A/U	31-2221	APL	2110-01-1014	1.000
R20	POT,10K	70A1G040-R103M	A-B	4610-13-3103	1.000
S02	SWITCH ASSY, ROTARY SR000-032	SR000-032	W-I	5104-00-0019	1.000
W01	CABLE ASSY,12-1/8 IN	WX3000-200-W1	W-I	1217-90-0001	1.000
ZA02	METER BD,B006	B006IH	W-I	1110-00-0741	1.000
ZA03	PWR SW ASSY,16-1/2	3000-PWR SW	W-I	1212-00-0006	1.000

WAVETEK PARTS LIST	FP ASSY,3007	1216-00-0145 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	TERMINAL,MALE	02-09-2118	MOL	2113-09-0004	4.000
P201	PLUG	19-09-2042	MOL	2113-26-0001	1.000
S201	SWITCH,TOGGLE DPDT	9201F3HZQ	C-K	5106-00-0016	1.000

WAVETEK PARTS LIST	PWR SW ASSY,16-1/2	1212-00-0006 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	TERM,MINI-PVMC000-092	47217	BER	2113-20-0001	3.000
2	HSG,MINI-LATCH,4-PIN MC000-120	65039-033	BER	2113-10-0006	1.000
3	PLUG,POLARIZING MC000-117	65307-001	BER	2113-23-0001	1.000

WAVETEK PARTS LIST	HARNESS,3000-200-FP	1219-00-0108 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
2	HSNG.,11-PIN,MINI-LATCH	65039-026	BER	2113-10-0011	2.000
3	PLUG,POLARIZING MC000-117	65307-001	BER	2113-23-0001	2.000
4	TERM,MINI-PVMC000-092	47217	BER	2113-20-0001	20.000

WAVETEK PARTS LIST	HARNESS,3000-200-SW	1219-00-0102 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
2	SW. MTG. BRKT.	A001-288	W-I	1410-00-3710	1.000
3	MTG. BRKT.	A001-289	W-I	1410-00-3720	1.000
4	BRKT, LOCK PLATE	A000-989	W-I	1410-00-2590	1.000
5	SW. BRKT.	A001-379	W-I	1410-00-3990	2.000
6	INDICATOR,SLIDE TROL	A000-991	W-I	1410-00-2600	1.000
7	SCW,SBH,4-40X3/16	4021NP-3/16	F-S	2810-17-4103	16.000
8	SCW,SFH,4-40X3/16	2130NP	F-S	2810-19-4103	1.000
9	LO,WASHER,INT,4 HW101-400	1331NP	F-S	2810-24-4000	3.000
12	BRKT	A001-290	W-I	1410-00-3730	1.000
14	LOWASHER,INT,1/2,ID HW103-000	30-100	F-S	2810-28-0002	1.000
17	WASHER,FLAT,4	1403ZP	F-S	2810-26-4000	8.000
18	PCSPY & POT BRKT	A001-292	W-I	1410-00-3750	1.000
19	MTG. POST SW. BRKT.	A001-291	W-I	1410-00-3740	2.000
21	SLIDE-TROL	A000-958	W-I	1410-00-2560	1.000
A01	MOD BD SUBAY,C316-7	C316-7-SUB	W-I	1218-00-0682	1.000
HH01	HARNESS, MOD BD	WYC316-2	W-I	1219-00-0283	1.000
R44	RES,SLIDETROL,10K PER B/P	RP137-310	W-I	4610-12-9103	1.000
R62	POT/SWITCH 10K 10% RP150-310	70K1G040R103U(1001)	A-B	4610-30-8103	1.000
S01 S02	LEVER SWITCH FROM:5101-00-0007	SL000-003	W-I	5101-00-0003	2.000
S03	SWITCH,P/O POT ASSY	SWITCH	W-I	5199-00-9999	1.000
S101	LEVER SWITCHSL000-002	L20-35AD	CHE	5101-00-0002	1.000
S102 S103	LEVER SWITCHSL001-002	L20-36AD	CHE	5101-00-0004	2.000
S104	LEVER SWITCHSL002-002	L20-37AD	CHE	5101-00-0005	1.000
S105 S106	LEVER SWITCHSL003-002	L20-17AJ	CHE	5101-00-0006	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	PC BOARD,Z373F FROM:3210-05-0044	Z373F	W-I	1710-00-0682	1.000
13	GRIPLET-FUNNEL,.070 HT123-000	47299	BER	2112-19-0003	21.000
15	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	4.000
16	SKT,XISTR MC000-072	02-04-1875-2CL	MOL	2112-00-0010	12.000
C01 C06 C12 C13	CAP,TANT,50V,.47UF	T310A474050AS	UNCAR	1510-21-9470	4.000
C02 C03 C07 C08	CAP,MICA,500V,470PF	DM15-471J	ARC	1510-50-0471	4.000
C04 C09 C10	CAP,MICA,500V,.001UF	DM15-102J	ARC	1510-50-0102	3.000
C05	CAP,DISC,1KV,330PF	10TCU-T33	SPR	1510-10-3331	1.000
C11	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C14	CAP,DISC,100V,.05UF	TG-550	SPR	1510-10-2503	1.000
C15	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	1.000
C16 C17 C18	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	3.000
CR1 CR2 CR3 CR4 CR7	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	5.000
IC01 IC02	DUAL OP AMP,RAY ONLY	RC4558NB-RAY	RAY	7000-45-5801	2.000
IC03	OP. AMPL. DUAL LOW NOISE	NE5532AN	SIG	7000-55-3201	1.000
IC4	TIMER	MC1455P1	MOT	7000-14-5300	1.000
DC1	LED,AXIAL VACTROL MP000-002	VTL5C3	VAC	3710-00-0001	1.000
P1	PLUG,LOCKING	09-65-1121	MOL	2112-05-0004	1.000
Q1 Q2	TRANS QA054-580	2N5458	MOT	4901-05-4580	2.000
Q03	TRANS QA039-040	2N3904	NAT	4901-03-9040	1.000
R01* R17 R30	RES,C,1/4W,5%,270K	CF1/4-270K	ASE	4700-15-2703	3.000
R02 R05 R16 R37	RES,C,1/4W,5%,10M	CB1065	A-B	4700-15-1005	4.000
R03 R12 R26 R54	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	4.000
R04* R18*	RES,C,1/4W,10%,5.6M	CB5651	A-B	4700-16-5604	2.000
R06 R21*	RES,C,1/4W,5%,4.7M	CB4755	A-B	4700-15-4704	2.000
R07* R34 R35	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	3.000
R08	RES,MF,1/8W,1%,178K	RN55D-178K	MILSP	4701-03-1783	1.000
R10 R9	RES,MF,1/8W,1%,340K	RN55D-340K	MILSP	4701-03-3403	2.000
R11 R13 R25 R27	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	4.000
R14	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R15*	RES,C,1/4W,5%,390K	CF1/4-390K	ASE	4700-15-3903	1.000
R19 R20 R53	RES,C,1/4W,10%,22M	CB2261	A-B	4700-16-2205	3.000
R22	RES,MF,1/8W,1%,464K	RN55D-464K	MILSP	4701-03-4643	1.000
R23 R24	RES,MF,1/8W,1%,845K	RN55D-845K	MILSP	4701-03-8453	2.000
R28	RES,C,1/4W,5%,560K	CF1/4-560K	ASE	4700-15-5603	1.000
R29	RES,C,1/4W,5%,7.5K	CF1/4-7.5K	ASE	4700-15-7501	1.000
R31	RES,MF,1/8W,1%,4.87K	RN55D-4.87K	MILSP	4701-03-4871	1.000
R32 R42 R47	POT,1K,RP129-210	360S102B	CTS	4610-00-1102	3.000
R33	RES,MF,1/8W,1%,12.1K	RN55D-12.1K	MILSP	4701-03-1212	1.000
R36	POT,20K,RP129-320	360S203B	CTS	4610-00-1203	1.000
R38	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R39	RES,C,1/4W,5%,18K	CF1/4-18K	ASE	4700-15-1802	1.000
R40*	RES,C,1/4W,5%,620K	CB6245	A-B	4700-15-6203	1.000
R41	RES,MF,1/8W,1%,2.74K	RN55D-2.74K	MILSP	4701-03-2741	1.000
R43	RES,MF,1/8W,1%,5.11K	RN55D-5.11K	MILSP	4701-03-5111	1.000
R46	RES,MF,1/8W,1%,16.5K	RN55D-16.5K	MILSP	4701-03-1652	1.000
R48	RES,MF,1/8W,1%,1.50K	RN55D-1.50K	MILSP	4701-03-1501	1.000
R49	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R50	RES,C,1/4W,5%,200	CF1/4-200	ASE	4700-15-2000	1.000
R51	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	1.000
R52	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000
R55	RES,C,1/4W,5%,47M	CB4765	A-B	4700-15-4705	1.000
R56	RES,C,1/4W,5%,620	CF1/4-620	ASE	4700-15-6200	1.000
S22	LEVER SWITCHSL000-002	L20-35AD	CHE	5101-00-0002	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
8	SCW,SBH,4-40X3/16	4021NP-3/16	F-S	2810-17-4103	2.000
9	WASHER,FLAT,4	1403ZP	F-S	2810-26-4000	2.000
14	SPACER,2X1/8HD103-202	109220	F-S	2810-04-2002	1.000
15	SPACER,2 X 7/32	109223	F-S	2810-04-2047	1.000
C10	CAP,MYLR,100V,.15UF	WMF1P15	C-D	1510-60-2154	1.000
C11	CAP,ELEC,3V,2000UF	500D208G003FH7	SPR	1510-21-8202	1.000
J05 J06 J07	RECEP,15-CKT,NYLON	03-09-1151	MOL	2112-21-0001	3.000
M1B	MI000-005 METER FACE PLATE, 4 SCALE	MI000-005	W-I	2410-06-0003	1.000
R57	RES,C,1/4W,5%,1.5M	CF1/4-1.5M	ASE	4700-15-1504	1.000

WAVETEK PARTS LIST	METER BD,B006	1110-00-0741 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
5	PC BOARD, Z398F FROM:3210-05-0044	Z398F	W-I	1710-00-0742	1.000
6	GRIPLET-FUNNEL,.070 HT123-000	47299	BER	2112-19-0003	6.000
7	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	6.000
C1	CAP,VAR,3.5-13PF	7S-TRIKO-02-3.5-13PF	STR	1510-70-0130	1.000
C2	CAP,DISC,1KV,10PF	10TCC-Q10	SPR	1510-10-0100	1.000
C3	CAP,DISC,1KV,20PF	60C0G200J	MDC	1510-10-0200	1.000
C4 C6 C7	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	3.000
C8	CAP,TANT,50V,.47UF	T310A474050AS	UNCAR	1510-21-9470	1.000
C9	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	1.000
CR03 CR04 CR05 CR06 CR07 CR08 CR09 CR10	DIODE,SIGNAL	1N914	G-E	4807-01-0914	8.000
CR11	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	1.000
IC1	IC,IL003-001	LF355N	NAT	7000-03-3500	1.000
IC2 IC3 IC4 IC5	DUAL OP AMP	RC4558NB	RAY	7000-14-5800	4.000
IC6	IC,IC000-030	LM318N	NAT	7000-03-1800	1.000
J1	CONN JF000-005	37JR116-1	S-C	2110-03-0002	1.000
P1 P2	PLUG,6-PIN KONEKTON MC000-075	09-65-1061	MOL	2112-05-0002	2.000
P3 P99	HEADER,4-PIN STRT REF:2112-07-0000	65501-404	BER	2112-07-0015	2.000
P97 P98	HEADER,11-PIN,STR. REF:2112-07-0000	65501-411	BER	2112-07-0016	2.000
Q1	TRANS QB000-009	MPS3702	NAT	4902-03-7020	1.000
Q02	TRANS QA039-040	2N3904	NAT	4901-03-9040	1.000
Q3	TRANS QA054-580	2N5458	MOT	4901-05-4580	1.000
R01 R18 R41	RES,C,1/4W,5%,20K	CF1/4-20K	ASE	4700-15-2002	3.000
R02 R04 R35	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	3.000
R03 R29 R32 R34 R36 R44	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	6.000
R05 R07 R27 R47 R56	POT,2K,RP130-220	89PR2K	BEK	4610-00-2202	5.000
R06	RES,C,1/4W,5%,9.1K	CF1/4-9.1K	ASE	4700-15-9101	1.000
R08	RES,C,1/4W,5%,910	CF1/4-910	ASE	4700-15-9100	1.000
R09	RES,MF,1/8W,1%,36.5K	RN55D-36.5K	MILSP	4701-03-3652	1.000
R10	POT,5K,RP130-250	89PR5K	BEK	4610-00-2502	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R11	RES,VAR.CERMET,10010%	89PR100	BEK	4610-00-2101	1.000
R12 R15	RES,MF,1/8W,1%,10K	RN55D-10K	MILSP	4701-03-1002	2.000
R13	RES,C,1/4W,5%,7.5K	CF1/4-7.5K	ASE	4700-15-7501	1.000
R14 R33	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	2.000
R16	RES,MF,1/8W,1%,11.3K	RN55D-11.3K	MILSP	4701-03-1132	1.000
R17	RES,MF,1/8W,1%,3.92K	RN55D-3.92K	MILSP	4701-03-3921	1.000
R19	RES,MF,1/8W,1%,2.74K	RN55D-2.74K	MILSP	4701-03-2741	1.000
R21 R23	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	2.000
R22 R24	RES,C,1/4W,5%,3.9K	CF1/43.9K	ASE	4700-15-3901	2.000
R25 R26 R28 R39 R40	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	5.000
R30	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	1.000
R31	RES,C,1/4W,5%,220K	CF1/4220K	ASE	4700-15-2203	1.000
R37 R38	RES,SET,2-10K,1/8W QTY:2:4701-03-1002	RX000-003	W-I	4789-00-0004	1.000
R42	RES,C,1/4W,5%,22K	CF1/422K	ASE	4700-15-2202	1.000
R43	RES,C,1/4W,5%,68K	CF1/4-68K	ASE	4700-15-6802	1.000
R45	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	1.000
R46	RES,MF,1/8W,1%,15.8K	RN55D-15.8K	MILSP	4701-03-1582	1.000
R48	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000
R49	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000
R50	RES,C,1/4W,5%,18K	CF1/4-18K	ASE	4700-15-1802	1.000
R51	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000
R52	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	1.000
R53	RES,C,1/4W,5%,10M	CB1065	A-B	4700-15-1005	1.000
R54	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R55	RES,MF,1/8W,1%,4.02K	RN55D-4.02K	MILSP	4701-03-4021	1.000
S1	SWITCH,SLIDESS000-005	SS-191-21	SCC	5105-00-0005	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
CR01	DIODE,ZENER,4.7V	1N4732	MOT	4801-01-4732	1.000
IC01 IC02	HEX INVERTER STATIC SENSITIVE	MC14069BP	MOT	8001-40-6912	2.000
IC03 IC04 IC05	NBCD ADDER STATIC SENSITIVE	MC14560CP	MOT	8001-45-6000	3.000
IC06 IC07	IC,IC000-012	SN7404N	T-I	8000-74-0400	2.000
IC08	VOLT REG,+5V	78M05U1C	FCD	7000-78-0500	1.000
P113	HDR,DBL,RA,SHRD,34	1-103166-5	AMP	2112-08-0068	1.000
P114	HEADER,RA,11-PIN FROM:2112-08-0000	2112-08-0069	W-I	2112-08-0069	1.000
R01 R02	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	2.000
R03	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R04	RES NTWK,SIP,9-3.3K	109-332J	EPITK	4770-00-0009	1.000
R05	RES NTWK,SIP,5-3.3K	605-332J	EPITK	4770-00-0007	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	2.000
C02 C08 C09 C10 C11	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	5.000
C03 C04	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	2.000
C05 C06 C07	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	3.000
C16	CAP,DISC,100V,.15UF	CY20A154M	C-L	1510-11-1154	1.000
CR01	DIODE,GC PT CONTACT	1N34A	HIT	4807-01-0034	1.000
CR02 CR03	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	2.000
CR04	DIODE,SIGNAL	1N914	G-E	4807-01-0914	1.000
IC01	OP AMP	N5741CV	SIG	7000-57-4100	1.000
IC02	TIMER	MC1455P1	MOT	7000-14-5500	1.000
J01 J02	CONN,SMA-F,50,PANEL	2056-0000	O-S	2110-02-1003	2.000
K01	RF RELAY 2PDT MR000-003	3SCS5007K1	G-E	4510-00-0003	1.000
L01 L02	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	2.000
Q01 Q02	TRANS QA039-040	2N3904	NAT	4901-03-9040	2.000
Q03	TRANS QB000-009	MPS3702	NAT	4902-03-7020	1.000
R01	RES,C,1/4W,5%,51	CF1/451	ASE	4700-15-5109	1.000
R03 R09	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	2.000
R04	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	1.000
R05	RES,C,1/4W,5%,360	CF1/4-360	ASE	4700-15-3600	1.000
R06	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	1.000
R07	RES,C,1/4W,10%,4.7K RC104-247AB	CB4721	A-B	4705-16-4701	1.000
R08 R13	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	2.000
R10	RES,C,1/4W,10%,22M	CB2261	A-B	4700-16-2205	1.000
R11	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	1.000
R12	RES,C,1/4W,10%,4.7M	CB4751	A-B	4700-16-4704	1.000
R14	RES,C,1/4W,5%,220	CF1/4-220	ASE	4700-15-2200	1.000
R15	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000
R17	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
S01	SWITCH,SM000-007	30-1	G-H	5111-00-0002	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C12 C13 C14 C15	CAP,FT,500V,470PF	FA5C-4712	A-B	1510-30-0471	4.000

WAVETEK PARTS LIST	MECH,B,M35-1	1216-00-0094 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
2	FUSE CARRIER, 3AG	031.1666	PCC	2410-05-0009	1.000
3	FUSEHOLDER,BODY WITH MTNG.NUT	031.1653	PCC	2410-05-0010	1.000
A01	PC ASSY,DPS2A/B/C	DPS2A-PC BD	W-I	1218-00-0252	1.000
A02	LINE CORD ASSY	3000-LINE CORD	W-I	1219-00-0144	1.000
A03	XFMR ASSY, DPS2A	DPS2A-XFMR	W-I	1219-00-0421	1.000
F01	FUSE,S.B.,2AMP	MDX-2	BUS	2410-05-0001	1.000
F101	FUSE,SLO BLO,1 AMP, 250V	MDL-1	BUS	2410-05-0005	1.000
IC101	POS, VOLTAGE REG.	LM317T	NAT	7000-03-1700	1.000
J201	RECEPTACLE,4 PIN	19-09-1042	MOL	2113-26-0002	1.000
Q101 Q102	PROT PWR DARLINGTON	LM395T	NAT	4902-00-3950	2.000
S101	SWITCH,SLIDE,DPDT	4021.0512	MARQ	5105-00-0011	1.000

WAVETEK PARTS LIST	PWR SUPPLY,DPS2A	1115-00-0034 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	1.000
2	SKT,XISTR MC000-072	02-04-1875-2CL	MOL	2112-00-0010	4.000
3	FUSE CLIP MF000-012	102071(TIN)	LIT	2410-05-1003	2.000
C01 C08	CAP,ELEC,50V,1500UF	WBR1500-50	C-D	1510-20-1152	2.000
C02 C06	CAP,DISC,100V,.005UF	TG-D50	SPR	1510-10-2502	2.000
C03 C09	CAP,ELEC,25V,100UF	TE1211	SPR	1510-20-4101	2.000
C04 C05 C07	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	3.000
C10	CAP,ELEC,16V,10000UF	D76381	SPR	1510-21-4103	1.000
C11	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	1.000
CR01	DIODE BRIDGE	MDA201	MOT	4806-02-0017	1.000
CR02 CR04	DIODE,SIGNAL	1N914	G-E	4807-01-0914	2.000
CR03 CR05 CR08	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	3.000
CR06 CR07	DIODE,RECT,200V	1N5624	G-E	4806-01-5624	2.000
IC01	VOLTAGE REFERENCE	REF-02CJ	PMI	7000-00-0200	1.000
IC02	DUAL OP AMP	TL082CP	T-I	7000-00-8200	1.000
J01 J02 J03	CONN.,RECEPT.,3-PIN	6-86105-3	AMP	2112-25-0001	3.000
P01	PLUG,6-PIN KONEKTON MC000-075	09-65-1061	MOL	2112-05-0002	1.000
P02	CONN,MALE,9-PIN MC000-071	09-65-1091	MOL	2112-05-0001	1.000
Q01	JFET,N-CHANNEL	E232	SCX	4902-00-2320	1.000
Q02	TRANS QA039-060	2N3906	T-I	4901-03-9060	1.000
R01 R12 R14	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	3.000
R02	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R03	RES,C,1/4W,5%,39K	CF1/4-39K	ASE	4700-15-3902	1.000
R04	RES,MF,1/8W,1%,4.87K	RN55D-4.87K	MILSP	4701-03-4871	1.000
R05	POT,CERMET,500	89PR500	BEK	4610-00-2501	1.000
R06	RES,C,1/4W,5%,3.9K	CF1/43.9K	ASE	4700-15-3901	1.000
R08	RES,MF,1/8W,1%,13.0K	RN55D-13.0K	MILSP	4701-03-1302	1.000
R09 R11	RES,MF,1/8W,1%,10K	RN55D-10K	MILSP	4701-03-1002	2.000
R10	POT,CERMET,200	89PR200	BEK	4610-00-2201	1.000
R13	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	1.000
R15	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R16	RES,MF,1/8W,1%,150	RN55D-150	MILSP	4701-03-1500	1.000
R18	RES,MF,1/8W,1%,768	RN55D-768	MILSP	4701-03-7680	1.000

WAVETEK PARTS LIST	PC ASSY,DPS2A/B/C	1218-00-0252 PAGE: 2	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	TERM,FEMALE	02-09-1118	MOL	2113-09-0003	2.000
P202	CORD SET,18/3SVT,6FT BK,MLD,CAP,UL-APPRV	6011-80-0001	ECMC	6011-80-0001	1.000

WAVETEK PARTS LIST	LINE CORD ASSY	1219-00-0144 PAGE: 1	F REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	CONTACT,MC000-131	08-50-0106	MOL	2113-07-0002	5.000
J101	CONN,6-PIN,KONEKTON MC000-076	09-50-3061	MOL	2113-06-0002	1.000
T101	XFMR,PWR	8720	A-M	5610-00-0027	1.000

WAVETEK PARTS LIST	XFMR ASSY, DPS2A	1219-00-0421 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
11	TUBE	A000-701	W-I	1410-00-1410	4.000
C10 C2 C9	CAP,DISC,50V,.01UF	CY15C103M	C-L	1510-10-8103	3.000
C11 C14 C17 C18 C4	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	5.000
C12 C15 C6 C7	CAP,DISC,1KV,470PF	60U471M	MDC	1510-10-1471	4.000
C16 C5	CAP,DISC,100V,.1UF	TGP-10	SPR	1510-10-2104	2.000
C21 C23 C25	CAP,TANT,50V,.47UF	T310A474050AS	UNCAR	1510-21-9470	3.000
CR1 CR12 CR13 CR2 CR3 CR4 CR5	DIODE,PIN	MA47047	M-A	4805-02-0003	7.000
CR10 CR11 CR6 CR7 CR8 CR9	DIODE,SI PT CONTACT	1N82AG	G-I	4807-01-0082	6.000
CR14 CR15	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	2.000
CR16	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	1.000
IC1	IC,IL001-002	MC-5121	NEC	7000-51-2100	1.000
IC2	DUAL OP AMP	RC4558NB	RAY	7000-14-5800	1.000
IC3	OP AMP	NE5741CV	SIG	7000-57-4100	1.000
J1 J2 J3	CONN JF000-005	37JR116-1	S-C	2110-03-0002	3.000
L01 L02 L03 L04 L11	TOROID,4T,1-1/4L	LA009-004-1	W-I	1810-05-0003	5.000
L5	CHOKE,COATED,10UH	08N100	JEF	1810-03-0100	1.000
L6	CHOKE,COATED,22UH	08N220	JEF	1810-03-0220	1.000
L07 L08 L09	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	3.000
L10 L12	TOROID,10T,1-1/2L	LA009-010-2	W-I	1810-05-0005	2.000
Q1 Q2	TRANS QA050-530	2N5053	APX	4901-05-0530	2.000
Q03 Q04	TRANS QA039-040	2N3904	NAT	4901-03-9040	2.000
R1	RES,C,1/2W,5%,68	CF1/2-68	ASE	4700-25-6809	1.000
R6 R8	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	2.000
R7	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	1.000
R9	RES,C,1/4W,5%,680	CF1/4-680	ASE	4700-15-6800	1.000
R10 R27	RES,C,1/8W,5%,270	CF1/8-270	ASE	4700-05-2700	2.000
R11 R2 R26 R5	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	4.000
R12 R14	RES,C,1/4W,5%,22K	CF1/422K	ASE	4700-15-2202	2.000
R13	RES,C,1/4W,5%,68	CF1/4-68	ASE	4700-15-6809	1.000
R15 R16 R35	RES,C,1/4W,5%,220	CF1/4-220	ASE	4700-15-2200	3.000
R17 R31	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R18	RES,MF,1/8W,1%,100K	RN55D-100K	MILSP	4701-03-1003	1.000
R19	RES,MF,1/8W,1%,178K	RN55D-178K	MILSP	4701-03-1783	1.000
R20 R30 R36 R39	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	4.000
R21 R41	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	2.000
R22	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	1.000
R23	POT,1K,RP131-210	360T102B	CTS	4610-00-3102	1.000
R24	RES,MF,1/8W,1%,47.5K	RN55D-47.5K	MILSP	4701-03-4752	1.000
R25	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000
R28 R29 R3 R32 R4	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	5.000
R33 R34	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000
R37	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R38	RES,C,1/4W,5%,1.5K	CF1/4-1.5K	ASE	4700-15-1501	1.000
R40	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	1.000
T01 T02	RF XFMR FROM:1813-00-0007	TR001-010	W-I	1210-40-0005	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C03 C08 C13 C19	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	5.000
C26	CAP,FT,500V,18PF	4420-18PF	AER	1510-30-9180	1.000
S01	SLIDE SWITCH	GF126	C-W	5105-00-0001	1.000

WAVETEK PARTS LIST	MECH,L,M43	1216-00-0117 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C20 C22 C27	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	3.000

WAVETEK PARTS LIST	MECH,B,M43	1216-00-0115 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
17	SHIELD COVER	A001-017	W-I	1410-00-2720	1.000
18	SHIELD COVER	A001-018	W-I	1410-00-2730	1.000
19	SHIELD COVER	A001-019	W-I	1410-00-2740	1.000
20	SHIELD	A001-381	W-I	1410-00-4000	1.000
24	SHIELD	A001-024	W-I	1410-00-2790	1.000
25	SHIELD	A001-025	W-I	1410-00-2800	1.000
26	SHIELD	A001-026	W-I	1410-00-2810	1.000
27	SHIELD	A001-027	W-I	1410-00-2820	2.000
28	SPACER,THD,4-40X3/8 HD101-406	108303NP	F-S	2810-02-4106	1.000
32	SHIELD	A001-180	W-I	1410-00-3330	1.000
34	CHASSIS TOP PLATE	A900-293	W-I	1410-00-4530	1.000
A01	MECH,L,M30-9	MECH-L-M30-9	W-I	1216-00-0149	1.000
C4 C5 C6 C7 C8	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	5.000
C9	CAP,ELEC,12V,100UF	ME4D100	ARC	1510-21-2101	1.000
C10	CAP,ELEC,6V,100UF	ME3B100	ARC	1510-21-1101	1.000
C13	CAP,DISC,1KV,47PF	10TCC-Q47	SPR	1510-10-0470	1.000
C14	CAP,CER,FACTORY ADJ. 0-15,NPO	1510-99-9997	W-I	1510-99-9997	1.000
C15	CAP,DISC,1KV,470PF	60U471M	MDC	1510-10-1471	1.000
C16	CAP,CER,FACTORY ADJ 20-27,N1500/25,NPO	1510-99-9998	W-I	1510-99-9998	1.000
C17	CAP,VAR,1.4-9.2PF	189-0563-001	JON	1510-70-6929	1.000
C19 C50	CAP,DISC,100V,.005UF	TG-D50	SPR	1510-10-2502	2.000
C20	CAP,MICA,500V,180PF	DM15-181J	ARC	1510-50-0181	1.000
C22	CAP,DISC,1KV,20PF	60C0G200J	MDC	1510-10-0200	1.000
C26 C34 C36 C39 C42 C47 C57	CAP,VAR,3.5-13PF	7S-TRIKO-02-3.5-13PF	STR	1510-70-0130	7.000
C27*	CAP,DISC,1KV,4.7PF	10TCC-V47	SPR	1510-10-0479	1.000
C29	CAP,DISC,50V,.001UF	8101-050-102M	ETP	1510-10-7102	1.000
C30	CAP,DISC,1KV,15PF	10TCC-Q15	SPR	1510-10-0150	1.000
C31	CAP,COMP,500V,2PF	QC-2.0PF	Q-C	1510-40-0020	1.000
C32	CAP,COMP,500V,4.7PF	MC-4.7PF	Q-C	1510-40-1479	1.000
C33 C38	CAP,COMP,500V,1.1PF	MC1.1PF	Q-C	1510-40-1119	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C29 C30 C31	CAP,FT,500V,6.8PF	54-794-010-6892	SPEC	1510-30-1689	4.000
C16 C17	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	2.000

WAVETEK PARTS LIST	MECH,B,M29-2	1216-00-0045 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	PC ASSY, M31A	M31A-PC	W-I	1218-00-1700	1.000
A02	MECH,B,M31A	MECH-B-M31A	W-I	1216-00-0046	1.000
C17	CAP,ELEC,12V,100UF	ME4D100	ARC	1510-21-2101	1.000
C18	CAP,ELEC,6V,100UF	ME3D100	ARC	1510-21-1101	1.000
C19 C20 C25 C28 C32 C37	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	6.000
CR04	LED,RED,T-1-3/4	NSL5046	NAT	4810-02-0001	1.000
IC13	VOLT REG,+5V	78M05U1C	FCD	7000-78-0500	1.000
J01 J02	CONN JF000-005	37JR116-1	S-C	2110-03-0002	2.000
L01 L02 L03 L04 L05 L06 L07 L08 L09 L10 L11 L12	TOROID,10T	LA009-010	W-I	1810-05-0002	12.000
L13 L14 L15 L16	TOROID,10T,3-1/4L	LA009-010-4	W-I	1810-05-0007	4.000
R30	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000

WAVETEK PARTS LIST	KHZ STEPS,M31A	1114-00-0465 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R13	RES,C,1/4W,5%,150K	CF1/4-150K	ASE	4700-15-1503	1.000
R17 R29 R56 R57	RES,MF,1/8W,1%,5.11K	RN55D-5.11K	MILSP	4701-03-5111	4.000
R18	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	1.000
R20 R23 R58	RES,MF,1/8W,1%,4.02K	RN55D-4.02K	MILSP	4701-03-4021	3.000
R26	RES,MF,1/8W,1%,33.2	RN55D-33.2	MILSP	4701-03-3329	1.000
R28 R39 R41 R42 R46	RES,MF,1/8W,1%,100	RN55D-100	MILSP	4701-03-1000	5.000
R34	RES,MF,1/8W,1%,845	RN55D-845	MILSP	4701-03-8450	1.000
R35 R50	RES,MF,1/8W,1%,1.1K	RN55D-1.1K	MILSP	4701-03-1101	2.000
R36 R37 R51	RES,MF,1/8W,1%,1.50K	RN55D-1.50K	MILSP	4701-03-1501	3.000
R43 R54	RES,MF,1/8W,1%,15K	RN55D-15K	MILSP	4701-03-1502	2.000
R47 R49	RES,MF,1/8W,1%,357	RN55D-357	MILSP	4701-03-3570	2.000
R48	RES,MF,1/8W,1%,2.10K	RN55D-2.10K	MILSP	4701-03-2101	1.000
R55	RES,MF,1/8W,1%,2.49K	RN55D-2.49K	MILSP	4701-03-2491	1.000

7.4 SCHEMATICS INDEX

The schematics appear in the following order:

SCHEMATIC	ASSEMBLY	DRAWING NO.
1	WIRING DIAGRAM	0014-30-0293
2	DPS2A POWER SUPPLY	0014-10-0209
3	M115	0014-30-0192
4	M172	0014-30-0258
5	M9W	0014-30-0178
6	M10W-17	0014-30-0298
7	M29-2	0014-30-0255
8	M30-9	0014-30-0294
9	M31A	0014-30-0120
10	M32A	0014-30-0134
11	M33-2	0014-30-0102
12	M34	0014-40-0016
13	M35-2	0014-20-0074
14	M43	0014-30-0107
15	M44-1	0014-30-0295
16	B006 METER BOARD	0014-30-0081
17	C316-7 MODULATION BD	0014-30-0296
18	2 MHz OFFSET BOARD	0014-20-0186

7.1 INTRODUCTION

This section contains all schematics for the instrument. A schematic index is given in Section 7.4.

7.2 SCHEMATIC NOTES

The following notes and abbreviations pertain to all schematics. Additional notes pertaining to specific schematics are included on each schematic if required.

All values are shown in the following units unless otherwise specified.

Components	Units
Resistor	ohms
Capacitor	picofarads
Inductor	microhenries

SYMBOL NOTES

Denotes DC voltage reading in volts unless otherwise specified.

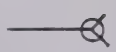
Denotes high impedance crystal detector reading in volts unless otherwise specified.

Denotes 50 ohm crystal detector reading in volts unless otherwise specified.

Signal or voltage source.

Connects to indicated signal or voltage source.

Arrow indicates clockwise rotation of wiper.

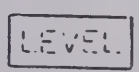


Coaxial jack

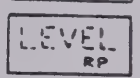
Coaxial plug

Coaxial cable

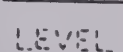
Factory adjusted part.



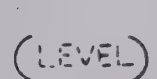
Denotes a front-panel device.



Denotes a rear-panel device.



Denotes a PC board adjustment or accessible module adjustment.



Denotes an internal module adjustment not accessible without removing module cover.

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
W02	CABLE ASSY,5 IN	WX3000-200-W2	W-I	1217-90-0002	1.000
W03	CABLE ASSY,5 IN	WX3000-200-W3	W-I	1217-90-0003	1.000
W04 W18 W20 W22	CABLE ASSY,6-1/2 IN	WX3000-200-W4	W-I	1217-00-0064	4.000
W05 W11 W12 W13 W15 W23 W24	CABLE ASSY,7-1/2 IN	WX3000-200-W11	W-I	1217-00-0074	7.000
W06	CABLE ASSY,8 IN	WX3000-200-W6	W-I	1217-02-0080	1.000
W07 W14	CABLE ASSY,2-1/4 IN	WX2000-A1	W-I	1217-00-0022	2.000
W08	CABLE ASSY,14-1/2 IN	WX3000-200-W8	W-I	1217-80-0004	1.000
W09	CABLE ASSY,8-1/2 IN	WX3000-200-W9	W-I	1217-00-0084	1.000
W10	CABLE ASSY,2-1/4 IN	WX3000-200-W10	W-I	1217-90-0004	1.000
W16	CABLE ASSY,3-1/4 IN	WX3001-W10	W-I	1217-00-0032	1.000
W17	CABLE ASSY,5-1/2 IN	WX3000-200-W5	W-I	1217-00-0054	1.000
W19	CABLE ASSY,3-3/4 IN	WX2000-A5	W-I	1217-00-0036	1.000
W21	CABLE ASSY,10-1/4 IN	WX3000-200-W21	W-I	1217-00-0102	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MECH SUBAY B,M34	MECH-B-M34	W-I	1216-00-0055	1.000
C07	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	1.000
C13*	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	1.000
IC01	VOLT REG,+5V	78M05U1C	FCD	7000-78-0500	1.000
J01 J02 J03 J04 J05	CONN JF000-005	37JR116-1	S-C	2110-03-0002	5.000
L02 L04	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	2.000

WAVETEK PARTS LIST	MECH SUBAY L,M34	1216-00-0054 PAGE: 1	D REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C02 C06 C09	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	3.000
C14 C15 C16 C17 C20	CAP,FT,500V,6.8PF	54-794-010-6892	SPEC	1510-30-1689	5.000
C18 C19	CAP,FT,500V,120PF	54-794-001-121K	SPEC	1510-30-1121	2.000

WAVETEK PARTS LIST	MECH SUBAY B,M34	1216-00-0055 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C301	CAP,FT,500V,39PF	4420-39PF	AER	1510-31-0390	1.000
C302	CAP,FT,500V,27PF	4420-27PF	AER	1510-31-0270	1.000
C303 C306 C308 C320	CAP,DISC,50V,.01UF	CY15C103M	C-L	1510-10-8103	4.000
C304 C305 C307 C309 C310 C312	CAP,FT,500V,2200PF	4420-2200PF	AER	1510-31-1222	6.000
C311 C321 C322	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	3.000
C313 C315 C316	CAP,FT,500V,120PF	4420-120PF	AER	1510-31-2121	3.000
C314	CAP,FT,500V,150PF	4420-150PF	AER	1510-31-2151	1.000
C317	CAP,FT,500V,360PF	4420-360PF	AER	1510-31-2361	1.000
C318	CAP,FT,500V,18PF	4420-18PF	AER	1510-30-9180	1.000
C319	CAP,DISC,1KV,100PF	10TCU-T10	SPR	1510-10-3101	1.000
CR301 CR302 CR303	DIODE,SIL,HOT CAR DG000-013	5082-3188	H-P	4812-02-0002	3.000
L06 L308	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	2.000
L302	CHOKE,COATED,4.7UH	08N4R7	JEF	1810-03-0479	1.000
L303	TOROID,4T,1-1/4L	LA009-004-1	W-I	1810-05-0003	1.000
L304	CHOKE,COATED,.47UH	08NR47	JEF	1810-03-0478	1.000
L305 L306 L307	CHOKE,COATED,1UH	08N1R0	JEF	1810-03-0010	3.000
Q301 Q302 Q303 Q304	TRANS QA050-530	2N5053	APX	4901-05-0530	4.000
R05	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	1.000
R301 R308 R310	RES,C,1/8W,5%,22K	CF1/8-22K	ASE	4700-05-2202	3.000
R302 R307 R309 R313	RES,C,1/8W,5%,47	CF1/8-47	ASE	4700-05-4709	4.000
R303 R305 R311	RES,C,1/8W,5%,2.2K	CF1/8-2.2K	ASE	4700-05-2201	3.000
R304 R306 R312	RES,C,1/8W,5%,390	CF1/8-390	ASE	4700-05-3900	3.000
R314 R315 R316	RES,C,1/8W,5%,2K	CF1/8-2K	ASE	4700-05-2001	3.000
R317	RES,MF,1/8W,1%,15K	RN55D-15K	MILSP	4701-03-1502	1.000
R318	RES,MF,1/8W,1%,1K	RN55D-1K	MILSP	4701-03-1001	1.000
R319	RES,MF,1/8W,1%,499	RN55D-499	MILSP	4701-03-4990	1.000
R320	RES,MF,1/8W,1%,2.43K	RN55D-2.43K	MILSP	4701-03-2431	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C601	CAP,FT,500V,18PF	4420-18PF	AER	1510-30-9180	1.000
CR601 CR602	DIODE,SCHOTTKY	5082-2835	H-P	4809-02-0002	2.000
R601	RES,C,1/8W,5%,47	CF1/8-47	ASE	4700-05-4709	1.000
R602	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	1.000
T601	RF XFMR FRUM:1813-00-0007	TR001-002	W-I	1210-40-0002	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101 C104 C203	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	3.000
C102 C103	CAP,DISC,50V,.001UF	8101-050-102M	ETP	1510-10-7102	2.000
C105	CAP,COMP,500V,1.5PF	QC-1.5PF	Q-C	1510-40-0159	1.000
C201 C204	CAP,DISC,100V,.005UF	TG-D50	SPR	1510-10-2502	2.000
C202* C207 C210	CAP,DISC,1KV,6.8PF	60C0H6R8D	MOC	1510-10-0689	3.000
C205*	CAP,COMP,500V,2.7PF	QC-2.7PF	Q-C	1510-40-0279	1.000
C206	CAP,COMP,500V,4.7PF	MC-4.7PF	Q-C	1510-40-1479	1.000
C208 C209	CAP,DISC,1KV,15PF	10TCC-D15	SPR	1510-10-0150	2.000
CR101 CR102	DIODE,PIN	MA47047	M-A	4805-02-0003	2.000
CR103 CR104	DIODE,SCHOTTKY	5082-2835	H-P	4809-02-0002	2.000
L101	FERRITE CHOKE,1 TURN FROM:1813-00-0007	LA007-001	W-I	1210-30-0004	1.000
L102	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	1.000
L201	COIL,AIR,24 GA,4T	1815-00-0113	W-I	1815-00-0113	1.000
L202 L203	COIL,AIR,24GA,6T	1815-00-0115	W-I	1815-00-0115	2.000
L204	COIL,AIR,24 GA,5T	1815-00-0114	W-I	1815-00-0114	1.000
Q201 Q202	TRANS QA050-530	2N5053	APX	4901-05-0530	2.000
R101 R102	RES,C,1/8W,5%,47K	CF1/8-47K	ASE	4700-05-4702	2.000
R103	RES,C,1/4,5%,27	CF1/4-27	ASE	4700-15-2709	1.000
R201	RES,C,1/4W,5%,820	CF1/4-820	ASE	4700-15-8200	1.000
R202	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	1.000
R203	RES,C,1/4W,5%,68	CF1/4-68	ASE	4700-15-6809	1.000
R204	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	1.000
R205	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	1.000
T101	RF XFMR FROM:1813-00-0007	TR001-001	W-I	1210-40-0001	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C501	CAP,DISC,1KV,25PF	60C0G250J	MDC	1510-10-0250	1.000
C502	CAP,MYLR,200V,.022UF	WMF2S22	C-D	1510-60-0223	1.000
C503	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	1.000
C504 C507	CAP,DISC,100V,.05UF	TG-S50	SPR	1510-10-2503	2.000
C505	CAP,DISC,1KV,150PF	60U151M	MDC	1510-10-1151	1.000
C506	CAP,DISC,1KV,470PF	60U471M	MDC	1510-10-1471	1.000
C508	CAP,DISC,100V,.005UF	TG-D50	SPR	1510-10-2502	1.000
C509	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
CR501 CR502 CR503 CR504 CR505 CR506	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	6.000
IC501	DUAL OP AMP,T-I ONLY	RC4558P-(T-I)	T-I	7000-45-5802	1.000
IC502	DUAL OP AMP,RAY ONLY	RC4558NB-RAY	RAY	7000-45-5801	1.000
Q501	TRANS QA054-580	2N5458	MOT	4901-05-4580	1.000
Q502	TRANS QA054-610	2N5461	MOT	4901-05-4610	1.000
R501	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	1.000
R502	RES,C,1/4W,5%,82K	CF1/4-82K	ASE	4700-15-8202	1.000
R503	RES,C,1/4W,10%,1.2K	CB1221	A-B	4705-16-1201	1.000
R504 R510	RES,C,1/4W,10%,3.3K RC104-233AB	CB3321	A-B	4705-16-3301	2.000
R505	RES,C,1/4W,5%,27K	CF1/4-27K	ASE	4700-15-2702	1.000
R506	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	1.000
R507 R508	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	2.000
R509	RES,C,1/4W,10%,2.2M RC104-522AB	CB2251	A-B	4705-16-2204	1.000
R511	RES,C,1/4W,10%,4.7K RC104-247AB	CB4721	A-B	4705-16-4701	1.000
R512 R514	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	2.000
R513 R515	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	2.000
R516 R519 R521	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	3.000
R517 R518	RES,C,1/4W,5%,680K	CF1/4-680K	ASE	4700-15-6803	2.000
R520 R522	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C401 C404	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	2.000
C402	CAP,DISC,100V,.005UF	TG-D50	SPR	1510-10-2502	1.000
C403	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
CR401 CR402 CR403 CR404 CR405 CR406 CR407 CR408	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	8.000
IC401	DUAL OP AMP	RC4558NB	RAY	7000-14-5800	1.000
Q401 Q402 Q403 Q405	TRANS QA039-040	2N3904	NAT	4901-03-9040	4.000
Q404	TRANS QB000-009	MPS3702	NAT	4902-03-7020	1.000
R401 R403	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	2.000
R402 R410 R417	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	3.000
R404 R405	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	2.000
R406	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R407	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	1.000
R408 R409	RES,C,1/4W,5%,7.5K	CF1/4-7.5K	ASE	4700-15-7501	2.000
R411	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	1.000
R412	RES,C,1/4W,5%,1M	CF1/4-1M	ASE	4700-15-1004	1.000
R413 R418	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	2.000
R414	RES,C,1/4W,5%,330K	CF1/4-330K	ASE	4700-15-3303	1.000
R415	RES,C,1/4W,5%,2.2M	CF1/4-2.2M	ASE	4700-15-2204	1.000
R416	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	1.000
R419	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	WB MXR/AMP,M34	M34-MXR/AMP	W-I	1219-00-0429	1.000
A02	PHASE LK ASSY,M34	M34-PH LK BD-200	W-I	1218-00-0334	1.000
A03	LEV ASSY,M34	M34-LEV BD-200	W-I	1218-00-0314	1.000
A04	VIDEO MIXER,M34	M34-VID MXR	W-I	1219-00-0430	1.000
A05	VIDEO AMP,M34	M34-VIDEO	W-I	1219-00-0431	1.000
A06	MECH SUBAY L,M34	MECH-L-M34	W-I	1216-00-0054	1.000
C01	CAP,ELEC,12V,100UF	ME4D100	ARC	1510-21-2101	1.000
C03	CAP,ELEC,6V,100UF	ME3B100	ARC	1510-21-1101	1.000
C04 C05 C08	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	3.000
C10 C11 C12	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	3.000
C21	CAP,DISC,1KV,200PF	CCD-201	ARC	1510-10-1201	1.000
C602	CAP,FT,500V,39PF	4420-39PF	AER	1510-31-0390	1.000
CR01	DIODE,SCHOTTKY	5082-2835	H-P	4809-02-0002	1.000
CR02	LED,RED,T-1-3/4	NSL5046	NAT	4810-02-0001	1.000
IC02	PHASE DETECTOR	MC4044P	MOT	8000-40-4400	1.000
L01	FERRITE CHOKE,1 TURN FROM:1813-00-0007	LA007-001	W-I	1210-30-0004	1.000
L03 L05 L07 L08 L09 L11 L12	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	7.000
L10	TOROID,10T,1-1/2L	LA009-010-2	W-I	1810-05-0005	1.000
L301 L601	CHOKE,COATED,4.7UH	08N4R7	JEF	1810-03-0479	2.000
R01	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	1.000
R02 R07	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	2.000
R03 R08	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	2.000
R04	RES,C,1/8W,5%,47	CF1/8-47	ASE	4700-05-4709	1.000
R06	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	>< ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R52 R53	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	2.000
R55	RES,MF,1/8W,1%,48.7K	RN55D-48.7K	MILSP	4701-03-4872	1.000
R61	RES,C,1/4W,5%, 2.4K	CF1/4-2.4K	ASE	4700-15-2401	1.000

WAVETEK PARTS LIST	PC ASSY, M172	1218-00-1670 PAGE: 2	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	>< ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C06 C07 C08 C09 C10 C11 C12 C13 C14 C15 C16 C17 C18	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	13.000
C19	CAP,FT,500V,6.8PF	54-794-010-6892	SPEC	1510-30-1689	1.000
C20 C21	CAP,FT,500V,120PF	54-794-001-121K	SPEC	1510-30-1121	2.000

WAVETEK PARTS LIST	MECH,B,M172	1216-00-0047 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	3.000
2	IC SKT,16 PIN MC000-074	DILB-16P-108	BURND	2112-00-0012	3.000
C01 C02 C03	CAP,DISC,50V,.01UF	CY15C103M	C-L	1510-10-8103	3.000
C04 C05	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
CR01 CR02 CR03 CR04 CR05 CR06 CR07 CR08	DIODE,SIGNAL	1N914	G-E	4807-01-0914	8.000
IC01 IC02 IC07	DUAL OP AMP,RAY ONLY	RC4558NB-RAY	RAY	7000-45-5801	3.000
IC03	VOLTAGE REF	REF-01CJ	PMI	7000-00-0100	1.000
IC04 IC05 IC06	DAC,2-DIGIT,BCD	DAC-20CQ	PMI	8000-00-0200	3.000
Q01	TRANS-QA042-500	PN4250	FCD	4901-04-2500	1.000
Q02	TRANS QA050-880	2N5088	MOT	4901-05-0880	1.000
Q3 Q4	TRANS QA039-040	2N3904	NAT	4901-03-9040	2.000
R01 R39	RES,MF,1/8W,1%,5.62K	RN55D-5.62K	MILSP	4701-03-5621	2.000
R02 R08 R18 R23 R31 R33	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	6.000
R03 R32	RES,MF,1/8W,1%,11.3K	RN55D-11.3K	MILSP	4701-03-1132	2.000
R04 R40	RES,MF,1/8W,1%,4.02K	RN55D-4.02K	MILSP	4701-03-4021	2.000
R06 R11 R12 R25	RES,C,1/4W,5%,330K	CF1/4-330K	ASE	4700-15-3303	4.000
R07 R10 R13 R24 R30 R34 R37	POT,100K,RP130-410	89PR100K	BEK	4610-00-2104	7.000
R09	RES,MF,1/8W,1%,3.01K	RN55D-3.01K	MILSP	4701-03-3011	1.000
R14 R49 R50 R51 R54 R56 R57 R58 R59 R60	RES,MF,1/8W,1%,5.11K	RN55D-5.11K	MILSP	4701-03-5111	10.000
R15 R17 R26	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	3.000
R16	RES,C,1/4W,5%,910K	CF1/4-910K	ASE	4700-15-9103	1.000
R19	RES,MF,1/8W,1%,16.5K	RN55D-16.5K	MILSP	4701-03-1652	1.000
R20	RES,MF,1/8W,1%,40.2K	RN55D-40.2K	MILSP	4701-03-4022	1.000
R21 R47 R48	RES,C,1/4W,5%,270K	CF1/4-270K	ASE	4700-15-2703	3.000
R22 R28	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	2.000
R27	RES,C,1/4W,5%,75K	CF1/4-75K	ASE	4700-15-7502	1.000
R29 R35	RES,C,1/4W,5%,220K	CF1/4220K	ASE	4700-15-2203	2.000
R36	RES,C,1/4W,5%,120K	CF1/4-120K	ASE	4700-15-1203	1.000
R41 R42	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	2.000
R43 R44 R45 R46	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	4.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MECH SUBAY B,M32A	MECH-B-M32A	W-I	1216-00-0058	1.000
C16 C17 C19	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	3.000
C21	CAP,VAR,.3-1.2PF	7263	JHSN	1510-70-9129	1.000
C22 C23	CAP,FT,250V,100PF	4420-100PF	AER	1510-30-3101	2.000
J01 J02 J03 J301	CONN JF000-005	37JR116-1	S-C	2110-03-0002	4.000
Q01	TRANS QA050-530	2N5053	APX	4901-05-0530	1.000
Q02	TRANS QB000-013	A430	APX	4902-00-4300	1.000
R07	RES,C,1/4W,5%,2.7	CF1/4-2.7	ASE	4700-15-2708	1.000

WAVETEK PARTS LIST	MECH SUBAY L,M32A	1216-00-0057 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C03 C04 C05 C06 C07 C08 C09 C10 C11 C12	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	10.000
C26 C27 C28 C29	CAP,FT,500V,470PF	FA5C-4712	A-B	1510-30-0471	4.000

WAVETEK PARTS LIST	MECH SUBAY B,M32A	1216-00-0058 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	PC ASSY, M172	M172-PC-SG-1170/U	W-I	1219-00-1670	1.000
A02	MECH,B,M172	MECH-B-M172	W-I	1216-00-0047	1.000
CR09	DIODE,ZENER,5.1V	1N5231	MOT	4801-01-5231	1.000
L01 L02	TOROID,10T	LA009-010	W-I	1810-05-0002	2.000
R62	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	1.000

WAVETEK PARTS LIST	SWP DRV/DAC,M172	1114-00-0473 PAGE: 1	C REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C301 C305	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	2.000
C302 C303 C304	CAP,DISC,50V,.001UF	8101-050-102M	ETP	1510-10-7102	3.000
C306	CAP,COMP,500V,1.1PF	MC1.1PF	Q-C	1510-40-1119	1.000
CR302	DIODE,PIN	MA47047	M-A	4805-02-0003	1.000
CR303 CR304	DIODE,SCHOTTKY	5082-2835	H-P	4809-02-0002	2.000
L301	FERRITE CHOKE,1 TURN FROM:1813-00-0007	LA007-001	W-I	1210-30-0004	1.000
L302	RF CHOKE,REF ONLY	CHOKE	W-I	1819-99-9999	1.000
R301 R302	RES,C,1/8W,5%,47K	CF1/8-47K	ASE	4700-05-4702	2.000
R303	RES,C,1/8W,5%,390	CF1/8-390	ASE	4700-05-3900	1.000
T301	RF XFMR FROM:1813-00-0007	TR001-001	W-I	1210-40-0001	1.000

WAVETEK PARTS LIST	MIXER,M32A	1219-00-0426 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C401	CAP,DISC,1KV,120PF	60U121M	MDC	1510-10-1121	1.000
C402	CAP,DISC,100V,.005UF	TG-D50	SPR	1510-10-2502	1.000
C403	CAP,FT,500V,39PF	4420-39PF	AER	1510-31-0390	1.000
L401	CHOKE,COATED,.10UH	08NR10	JEF	1810-03-0019	1.000
Q401 Q402	TRANS QA050-530	2N5053	APX	4901-05-0530	2.000
R401 R407 R408	RES,C,1/4W,5%,820	CF1/4-820	ASE	4700-15-8200	3.000
R402 R409	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	2.000
R403 R406	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	2.000
R404	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	1.000
R405	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000

WAVETEK PARTS LIST	VIDEO AMP,M32A	1219-00-0440 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	1.000
C102 C104	CAP.,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	2.000
C103	CAP.,CHIP,360PF,10%	100B361KP200X	ATC	1510-00-2361	1.000
C105	CAP,DISC,50V,.001UF	8101-050-102M	ETP	1510-10-7102	1.000
CR101 CR102 CR103	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	3.000
CR104	DIODE,SCHOTTKY	5082-2835	H-P	4809-02-0002	1.000
IC101	PROM,PGMD,M32A	8410-00-0001	W-I	8410-00-0001	1.000
IC102 IC103	DECADE COUNTER	SN74S196N	T-I	8007-41-9601	2.000
IC104	DUAL J-K FLIP-FLIP	SN74S112N	T-I	8007-41-1200	1.000
IC105	PHASE DETECTOR	MC4044P	MOT	8000-40-4400	1.000
J101	SOCKET,SIP,6-PIN	ICK-106-T	SMTC	2112-00-0017	1.000
J102	TERM.,MINISERT	75060-012	BER	2112-23-0001	1.000
L101 L102 L103 L104	TOROID,10T,1L	LA009-010-3	W-I	1810-05-0006	4.000
P101A P101B P101C P101D P101E P101F P101G P101H P101I P101J	EDGE-CLIP CONNECTOR	75382-001	BER	2112-22-0001	10.000
Q101	TRANS QA050-530	2N5053	APX	4901-05-0530	1.000
R101	RES NTWK,SIP,7-4.7K	807-472J	EPITK	4770-00-0006	1.000
R102	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	1.000
R103	RES,C,1/4W,5%,33	CF1/4-33	ASE	4700-15-3309	1.000
R104	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000
R105	RES,MF,1/8W,1%,2.10K	RN55D-2.10K	MILSP	4701-03-2101	1.000
R106	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000
R107	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R108	RES,MF,1/8W,1%,499	RN55D-499	MILSP	4701-03-4990	1.000
R109	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	1.000
R110 R111	RES,C,1/8W,5%,4.7K	CF1/8-4.7K	ASE	4700-05-4701	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201	CAP,DISC,100V,.005UF	TG-D50	SPR	1510-10-2502	1.000
C202	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C203 C210 C211	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	3.000
C204 C205	CAP,DISC,1KV,150PF	60U151M	MDC	1510-10-1151	2.000
C206 C207	CAP,FILM,250V,.047UF	818347254	REI	1510-60-9473	2.000
C208 C209	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
CR201 CR202 CR203 CR204	DIODE,SIGNAL	1N914	G-E	4807-01-0914	4.000
IC201 IC202 IC203	DUAL OP AMP,RAY ONLY	RC4558NB-RAY	RAY	7000-45-5801	3.000
OC201 OC202	LED,AXIAL VACTROL MP000-002	VTL5C3	VAC	3710-00-0001	2.000
P201	HEADER,6-PIN,STRGHT REF:2112-24-0000	65508-406	BER	2112-24-0001	1.000
P202A P202B P202C P202D P202E P202F P202G P202H P202I P202J P202K P202L	EDGE-CLIP CONNECTOR	75382-001	BER	2112-22-0001	12.000
R201 R221 R222	RES,C,1/4W,5%,6.8K	CF1/4-6.8K	ASE	4700-15-6801	3.000
R202 R203 R211	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	3.000
R204	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R205 R206	POT,CERMET,20K-OHM	A4C203	A-B	4610-13-5203	2.000
R207 R210	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	2.000
R208	RES,MF,1/8W,1%,2K	RN55D-2K	MILSP	4701-03-2001	1.000
R209 R225 R226	RES,C,1/4W,5%,220K	CF1/4220K	ASE	4700-15-2203	3.000
R212	RES,C,1/8W,5%,1K RC101-210	CF1/8-1K	ASE	4700-05-1001	1.000
R213	POT,CERMET,5K	A2B502	A-B	4610-13-4502	1.000
R214	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	1.000
R215	POT,CERMET,20K	A2B203	A-B	4610-13-4203	1.000
R216 R217 R219 R220	RES,C,1/8W,5%,30K	CF1/8-30K	ASE	4700-05-3002	4.000
R218	POT,CERMET,2K	A2B202	A-B	4610-13-4202	1.000
R223 R224	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000
R227	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000
R228	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	DIG PGM BD,M32A	M32A-DIG PGM BD	W-I	1218-00-0028	1.000
A02	OSC CTL BD,M32A	M32A-OSC CTL BD	W-I	1218-00-0027	1.000
A03	MIXER,M32A	M32A-MXR	W-I	1219-00-0426	1.000
A04	VIDEO AMP,M32A	M32A-VIDEO AMP	W-I	1219-00-0440	1.000
A05	MECH SUBAY L,M32A	MECH-L-M32A	W-I	1216-00-0057	1.000
C01	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	1.000
C02	CAP,ELEC,6V,100UF	ME3B100	ARC	1510-21-1101	1.000
C13	CAP,COMP,500V,3.9PF	QC 3.9PF	Q-C	1510-40-0399	1.000
C14	CAP,COMP,500V,.62PF	MC-.62PF	Q-C	1510-40-1628	1.000
C18	CAP,COMP,500V,3.9PF	MC-3.9PF	Q-C	1510-40-1399	1.000
C20	CAP,COMP,500V,1.1PF	MC1.1PF	Q-C	1510-40-1119	1.000
C24	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	1.000
C30 C31	CAP,,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	2.000
CR01	DIODE,VARACTOR	BB205B	APX	4803-02-0004	1.000
CR02	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	1.000
CR03	LED,RED,T-1-3/4	NSL5046	NAT	4810-02-0001	1.000
CR04 CR05 CR06	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	3.000
CR301	DIODE,PIN	MA47047	M-A	4805-02-0003	1.000
IC01	VOLT REG,+5V	78M05U1C	FCD	7000-78-0500	1.000
L01 L02 L03 L04 L05 L06 L07 L08 L09 L10 L13 L19	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	12.000
L13	CHOKE,COATED,.22UH	08NR22	JEF	1810-03-0228	1.000
Q03	TRANS QB000-035	BFR90	APX	4902-00-0900	1.000
R01	RES,C,1/8W,5%,68	CF1/8-68	ASE	4700-05-6809	1.000
R02	RES,C,1/8W,5%,2K	CF1/8-2K	ASE	4700-05-2001	1.000
R03	RES,C,1/4W,5%,430	CF1/4-430	ASE	4700-15-4300	1.000
R04 R08 R11	RES,C,1/8W,5%,4.7K	CF1/8-4.7K	ASE	4700-05-4701	3.000
R05 R10	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	2.000
R06	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	1.000
R09	RES,MF,1/8W,1%,499	RN55D-499	MILSP	4701-03-4990	1.000
R12	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	1.000
R13	RES,C,1/8W,5%,820	CF1/8-820	ASE	4700-05-8200	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MECH SUBAY B,M9W	MECH-B-M9W	W-I	1216-00-0049	1.000
C10 C11 C12 C20 C21 C26 C28 C36 C43 C46	CAP,FT,250V,100PF	4420-100PF	AER	1510-30-3101	10.000
C25	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	1.000
J01 J02 J201	CONN JF000-005	37JR116-1	S-C	2110-03-0002	3.000
R42	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	1.000
R51	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000

WAVETEK PARTS LIST	MECH SUBAY L,M9W	1216-00-0048 PAGE: 1	C REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C04 C22 C23	CAP,FT,500V,6.8PF	54-794-010-6892	SPEC	1510-30-1689	4.000
C02	CAP,FT,500V,470PF	FA5C-4712	A-B	1510-30-0471	1.000
C03	CAP,FT,500V,120PF	54-794-001-121K	SPEC	1510-30-1121	1.000
C37 C39	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	2.000

WAVETEK PARTS LIST	MECH SUBAY B,M9W	1216-00-0049 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101	CAP,COMP,500V,2.4PF	QC-2.4PF	Q-C	1510-40-0249	1.000
MX101	DIODE,QUAD,BAL MIXER STATIC SENSITIVE	5082-2930	H-P	4899-02-0001	1.000
T101	RF XFMR FROM:1813-00-0007	TR001-003	W-I	1210-40-0003	1.000
T102	RF XFMR FROM 1813-00-0009	TR002-001	W-I	1210-41-0001	1.000

WAVETEK PARTS LIST	MIXER,M9W	1219-00-0423 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201 C205	CAP,TANT,50V,.47UF	T310A474050AS	UNCAR	1510-21-9470	2.000
C202	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	1.000
C203 C204	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	2.000
C206	CAP,COMP,500V,2PF	QC-2.0PF	Q-C	1510-40-0020	1.000
CR201	DIODE,ZENER,6.8V	1N4736A	MOT	4801-02-0001	1.000
L201 L203	RF CHOKE,REF ONLY	CHOKE	W-I	1819-99-9999	2.000
L202	CHOKE,COATED,.22UH	08NR22	JEF	1810-03-0228	1.000
L204	TORUID,10T,1L	LA009-010-3	W-I	1810-05-0006	1.000
Q201 Q202 Q203	TRANS QA050-530	2N5053	APX	4901-05-0530	3.000
R201	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	1.000
R202	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	1.000
R203	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000
R204	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	1.000
R205 R206	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	2.000
R207	RES,C,1/4W,5%,150	CF1/4-150	ASE	4700-15-1300	1.000

WAVETEK PARTS LIST	PREAMP,M9W	1219-00-0424 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MIXER,M9W	M9W-MIXER	W-I	1219-00-0423	1.000
A02	PREAMP,M9W	M9W-PREAMP	W-I	1219-00-0424	1.000
A03	MECH SUBAY L,M9W	MECH-L-M9W	W-I	1216-00-0048	1.000
C05	CAP,COMP,500V,2PF	QC-2.0PF	Q-C	1510-40-0020	1.000
C06 C07 C08 C09 C24 C38 C40 C41 C42	CAP,TANT,50V,.47UF	T310A474050AS	UNCAR	1510-21-9470	9.000
C13	CAP.,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	1.000
C14 C15 C16 C17 C32 C33 C34	CAP,COMP,500V,10PF	QC-10PF	Q-C	1510-40-0100	7.000
C18 C35	CAP,DISC,1KV,120PF	60U121M	MDC	1510-10-1121	2.000
C19	CAP,DISC,100V,.02UF	TG-S20	SPR	1510-10-2203	1.000
C27	CAP,COMP,500V,1PF	QC-1PF	Q-C	1510-40-0010	1.000
C29	CAP,COMP,500V,.75PF	QC-.75PF	Q-C	1510-40-0758	1.000
C30	CAP,CHIP,1PF,100V CC101-R10	03C109CT	RPBLC	1510-00-0010	1.000
C31	CAP,COMP,500V,3PF	QC-3PF	Q-C	1510-40-0030	1.000
C44	CAP,DISC,1KV,100PF	60U101M	MDC	1510-10-1101	1.000
CR01 CR02 CR03 CR04 CR09	DIODE,VARACTOR	BB205B	APX	4803-02-0004	5.000
CR05 CR07 CR10	DIODE,PIN	MA47980	M-A	4805-02-0001	3.000
CR06 CR08 CR11	DIODE,1N82 MITEK PRE-TESTED,40UA	1N82-PRE-TEST	MTK	4807-03-0003	3.000
IC01 IC02 IC03 IC04	OP AMP	N5741T	SIG	7000-57-4101	4.000
L01 L21 L22	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	3.000
L02	TOROID,10T,1-1/2L	LA009-010-2	W-I	1810-05-0005	1.000
L03 L07 L08 L11 L12 L14 L15 L16 L17 L20	RF CHOKE,REF ONLY	CHOKE	W-I	1819-99-9999	10.000
L04	CHOKE,8T,32 GA FROM:4705-16-4701	1210-33-0001	W-I	1210-33-0001	1.000
L05 L09 L10 L13 L18 L19 L24	CHOKE,COATED,.22UH	08NR22	JEF	1810-03-0228	7.000
L06	CHOKE,.22MH,10% LA008-R02	506-000022V1	SYS	1810-04-0228	1.000
L23	TOROID,4T,1-1/4L	LA009-004-1	W-I	1810-05-0003	1.000
Q01	TRANS QB000-013	A430	APX	4902-00-4300	1.000
Q02	TRANS QA054-580	2N5458	MOT	4901-05-4580	1.000
Q03 Q04 Q06 Q07	TRANS QA050-530	2N5053	APX	4901-05-0530	4.000

WAVETEK PARTS LIST	SWP OSC,M9W	1114-00-0466 PAGE: 1	D REV

REFERENCE DESIGNATORS	PART DESCRIPTION	>< ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q05	TRANS QB000-018	SD1006	SSS	4902-01-0060	1.000
R01 R14	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	2.000
R02 R38	POT,5K,RP130-250	89PR5K	BEK	4610-00-2502	2.000
R03	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	1.000
R04 R27 R29 R60	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	4.000
R05	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000
R06 R40	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	2.000
R07	RES,C,1/4W,10%,10M RC104-610	CB1061	A-B	4700-16-1005	1.000
R08	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	1.000
R09	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	1.000
R10	RES,C,1/4W,5%,680	CF1/4-680	ASE	4700-15-6800	1.000
R11 R15	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	2.000
R12 R13	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	2.000
R16 R22 R28 R32 R33 R34 R50 R54 R59 R61	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	10.000
R17 R20 R23 R37 R39 R48 R51 R55	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	8.000
R18 R24 R52 R56	RES,C,1/4W,5%,560	CF1/4-560	ASE	4700-15-5600	4.000
R19 R21 R49 R53	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	4.000
R25 R46	POT,20K,RP130-320	89PR20K	BEK	4610-00-2203	2.000
R26 R31	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	2.000
R30 R57	POT,20K,RP129-320	360S203B	CTS	4610-00-1203	2.000
R35 R62	RES,C,1/2W,5%,47 RC105-047	EB4705	A-B	4705-25-4709	2.000
R36 R63	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	2.000
R41 R58	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	2.000
R43	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	1.000
R44	RES,C,1/2W,5%,150	CF1/2-150	ASE	4700-25-1500	1.000
R45	RES,C,1/4W,5%,3.9K	CF1/43.9K	ASE	4700-15-3901	1.000
R64	RES,C,1/4W,5%,270	CF1/4-270	ASE	4700-15-2700	1.000
R65	RES,C,1/4W,10%,1.2K	CB1221	A-B	4705-16-1201	1.000
R66	RES,1/4,5%,6.2K A-B RC103-262AB	CB6225	A-B	4705-15-6201	1.000
R68	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R17 R18	RES,MF,1/8W,1%,19.6K	RN55D-19.6K	MILSP	4701-03-1962	2.000
R19	RES,MF,1/8W,1%,2.10K	RN55D-2.10K	MILSP	4701-03-2101	1.000
R20	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000
R21	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R23	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000
R24	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	1.000
R28	RES,C,1/4W,5%,160K	CF1/4-160K	ASE	4700-15-1603	1.000
R29	RES,C,1/4W,5%,20K	CF1/4-20K	ASE	4700-15-2002	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03 C04 C05 C06 C07 C08 C09 C10 C11 C12 C13 C14 C15 C16	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	16.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C21 C22 C27 C29	CAP,FILM,100V,.12UF	MC124JIC	NPC	1510-60-8124	4.000
C23 C24 C26	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	3.000
C30	CAP,MICA,500V,.001UF	DM15-102J	ARC	1510-50-0102	1.000
C31	CAP,DISC,1KV,10PF	10TCC-Q10	SPR	1510-10-0100	1.000
C33 C34	CAP,MICA,500V,180PF	DM15-181J	ARC	1510-50-0181	2.000
C35	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C36	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	1.000
CR01	DIODE,VARACTOR	MV2301	MOT	4803-02-0008	1.000
CR02 CR03 CR05	DIODE,SIGNAL	1N914	G-E	4807-01-0914	3.000
IC01 IC02 IC12	IC,IC000-012	SN7404N	T-I	8000-74-0400	3.000
IC03 IC04 IC05 IC06	DECADE CTR PRESET LS	SN74LS196N	T-I	8007-41-9610	4.000
IC07	IC,IC000-019	SN74H102N	T-I	8007-41-0200	1.000
IC08	IC,IC000-018	N74H11A	SIG	8000-74-1100	1.000
IC09	PHASE DETECTOR	MC4044P	MOT	8000-40-4400	1.000
IC10	DUAL OP AMP	RC4558NB	RAY	7000-14-5800	1.000
IC11	OP AMP	N5741CV	SIG	7000-57-4100	1.000
L17	CHOKE,COATED,2.2UH	08N2R2	JEF	1810-03-0229	1.000
L18	CHOKE,COATED,.47UH	08NR47	JEF	1810-03-0478	1.000
L19	CHOKE,COATED,.22UH	08NR22	JEF	1810-03-0228	1.000
Q01	TRANS QA054-580	2N5458	MOT	4901-05-4580	1.000
Q02	TRANS QA053-060	2N5306	G-E	4901-05-3060	1.000
Q03 Q04	TRANS QA039-040	2N3904	NAT	4901-03-9040	2.000
R01 R02	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	2.000
R03 R04 R06 R07 R26	RES,C,1/4W,5%,30K	CF1/4-30K	ASE	4700-15-3002	5.000
R05	POT,2K,RP144-220 FROM:4610-00-7202	4610-00-4202	W-I	4610-00-4202	1.000
R08 R27	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	2.000
R09	RES,C,1/4W,5%,68K	CF1/4-68K	ASE	4700-15-6802	1.000
R10 R11 R14	RES,C,1/4W,5%,6.8K	CF1/4-6.8K	ASE	4700-15-6801	3.000
R12	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	1.000
R13 R22 R25	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	3.000
R15	RES,MF,1/8W,1%,30.1K	RN55D-30.1K	MILSP	4701-03-3012	1.000
R16	RES,MF,1/8W,1%,4.32K	RN55D-4.32K	MILSP	4701-03-4321	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C35 C37	CAP,COMP,500V,.47PF	MC-.47PF	Q-C	1510-40-1478	2.000
C43	CAP,FT,500V,27PF	4420-27PF	AER	1510-31-0270	1.000
C44 C49 C51 C52	CAP,DISC,1KV,10PF	10TCC-Q10	SPR	1510-10-0100	4.000
C53 C55	CAP,VAR,.5-3PF	R-TRIKO-107-02-M	STR	1510-70-1030	2.000
C54	CAP,COMP,500V,.1PF	MC-.1PF	Q-C	1510-40-1019	1.000
C56	CAP,COMP,500V,.75PF	MC-.75PF	Q-C	1510-40-1758	1.000
C60	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	1.000
CR1 CR2 CR4	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	3.000
CR3	DIODE,PIN	MA47980	M-A	4805-02-0001	1.000
CR5	DIODE,GE PT CONTACT	1N34A	HIT	4807-01-0034	1.000
CR6 CR7	DIODE DG000-012	5082-0180	H-P	4811-02-0001	2.000
IC1	VOLT REG,+5V	78M05U1C	FCD	7000-78-0500	1.000
IC2	OP AMP	N5741CV	SIG	7000-57-4100	1.000
L01 L02 L03	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	3.000
L7	CHOKE,COATED,.47UH	08NR47	JEF	1810-03-0478	1.000
L08 L16 L17	TOROID,4T,1-1/4L	LA009-004-1	W-I	1810-05-0003	3.000
L9	TOROID,4T	LA009-004	W-I	1810-05-0001	1.000
L10 L11 L21 L23 L24 L25	RF CHOKE,REF ONLY	CHOKE	W-I	1819-99-9999	6.000
L12 L13 L14 L15 L19	CHOKE,COATED,.22UH	08NR22	JEF	1810-03-0228	5.000
L18	CHOKE,COATED,.10UH	08NR10	JEF	1810-03-0019	1.000
L20	CHOKE,COATED,1UH	08N1R0	JEF	1810-03-0010	1.000
L26	GROUND LUG,#6,INT HG102-600	38-111	F-S	2112-03-0003	1.000
Q1 Q10 Q2 Q6 Q7 Q8 Q9	TRANS QA050-530	2N5053	APX	4901-05-0530	7.000
Q3	TRANSISTOR,NPN, MOT ONLY	2N5179-MOT	MOT	4901-05-1791	1.000
Q04 Q05 Q11	TRANS QA039-040	2N3904	NAT	4901-03-9040	3.000
R4	RES,MF,1/8W,1%,5.11K	RN55D-5.11K	MILSP	4701-03-5111	1.000
R05	RES,MF,1/8W,1%,10K	RN55D-10K	MILSP	4701-03-1002	1.000
R07 R14 R23 R41 R52	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	5.000
R10	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	1.000
R11 R22 R9	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	3.000
R12 R50	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R13	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	1.000
R15	RES,MF,1/8W,1%,40.2K	RN55D-40.2K	MILSP	4701-03-4022	1.000
R16	RES,MF,1/8W,1%,15K	RN55D-15K	MILSP	4701-03-1502	1.000
R17	RES,C,1/4W,5%,1.5K	CF1/4-1.5K	ASE	4700-15-1501	1.000
R18 R19 R6	RES,MF,1/8W,1%,2K	RN55D-2K	MILSP	4701-03-2001	3.000
R20	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000
R21	RES,C,1/4W,5%,220	CF1/4-220	ASE	4700-15-2200	1.000
R24	RES,C,1/8W,5%,10	CF1/8-10	ASE	4700-05-1009	1.000
R25 R26	RES,C,1/8W,5%,100 RC101-110	CF1/8-100	ASE	4700-05-1000	2.000
R27	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R28	RES,C,1/4W,5%,22K	CF1/422K	ASE	4700-15-2202	1.000
R29 R8	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	2.000
R30 R36 R43	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	3.000
R31 R35 R42 R51	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	4.000
R32 R38 R44 R45	RES,C,1/8W,5%,47	CF1/8-47	ASE	4700-05-4709	4.000
R33 R39 R49	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	3.000
R34 R37	RES,C,1/8W,5%,22	CF1/8-22	ASE	4700-05-2209	2.000
R40	RES,C,1/4W,5%,82	CF1/4-82	ASE	4700-15-8209	1.000
R46 R47	RES,C,1/8W,5%,270	CF1/8-270	ASE	4700-05-2700	2.000
R48	RES,C,1/4W,5%,10	CF1/4-10	ASE	4700-15-1009	1.000
T1	RF XFMR FROM:1810-03-0010	TR004-001	W-I	1210-43-0001	1.000
X1	CRYSTAL,X40W-1	X40W-1-00.00000	W-I	2310-10-0401	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101 C103 C104 C105 C106 C107	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	6.000
C102	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	1.000
IC101	DUAL D FLIP FLOP	SN74S74N	T-I	8000-82-7401	1.000
IC102	DECADE COUNTER	SN74S196N	T-I	8007-41-9601	1.000
IC103 IC104 IC105	DECADE CTR PRESET LS	SN74LS196N	T-I	8007-41-9610	3.000
L101 L102 L103 L104 L105 L106 L107	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	7.000
Q101	TRANS QA039-040	2N3904	NAT	4901-03-9040	1.000
R101	RES,C,1/4W,5%,390	CF1/4-390	ASE	4700-15-3900	1.000
R102	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	1.000
R103	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000
R104	RES,C,1/4W,5%,2K	CF1/4-2K	ASE	4700-15-2001	1.000
R105 R106	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
5	INDEX STUD	A001-009	W-I	1410-00-2680	1.000
6	NUT,6-32X1/4HN101-600	8005NP	F-S	2810-14-6100	2.000
7	INT,LOWASHER,6 HW101-600	1304ZP	F-S	2810-24-6000	2.000
8	SCW,SBH,6-32X1/4	6-32X1/4,UC,BH,NP	S-S	2810-17-6104	1.000
13	IC PCB, A001-007-08. FROM:3210-05-0048	A001-007-08	W-I	1410-00-2650	1.000
21	SHIELD	A001-021	W-I	1410-00-2760	1.000
22	SHIELD	A001-022	W-I	1410-00-2770	1.000
23	SHIELD	A001-023	W-I	1410-00-2780	1.000
A01	MECH,C,M30-9	MECH-C-M30-9	W-I	1216-00-0150	1.000
C21 C41 C46	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	3.000
C23 C48	CAP,FT,250V,100PF	4420-100PF	AER	1510-30-3101	2.000
C24 C25 C28 C40 C45	CAP,FT,500V,2200PF	4420-2200PF	AER	1510-31-1222	5.000
C43	CAP,FT,500V,27PF	4420-27PF	AER	1510-31-0270	1.000
J01 J02 J03 J04 J05 J06 J07 J08	CONN JF000-005	37JR116-1	S-C	2110-03-0002	8.000
ZA01	MECH SUBAY B,M30	MECH-B-M30	W-I	1216-00-0061	1.000

WAVETEK PARTS LIST	MECH,L,M30-9	1216-00-0149 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03 C18	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	4.000

WAVETEK PARTS LIST	MECH SUBAY B,M30	1216-00-0061 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	AMP BD,M10W-9/10	M10W-9-AMP BD	W-I	1218-00-0601	1.000
A02	LEV BD,M10W-9/10	M10W-9-LEV BD	W-I	1218-00-0611	1.000
C01	CAP,DISC,1KV,200PF	CCD-201	ARC	1510-10-1201	1.000
C02	CAP,COMP,500V,2.4PF	QC-2.4PF	Q-C	1510-40-0249	1.000
C03 C22	CAP.,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	2.000
C07 C29	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
C20	CAP,DISC,100V,.15UF	CY20A154M	C-L	1510-11-1154	1.000
C21	CAP,FT,250V,500PF	4420-500PF	AER	1510-30-3501	1.000
C27	CAP,DISC,50V,.01UF	CY15C103M	C-L	1510-10-8103	1.000
C28	CAP,DISC,100V,.05UF	TG-850	SPR	1510-10-2503	1.000
C30*	CAP,VALUE DETERMINED IN CALIBRATION	CAP,TRIM	W-I	1519-99-9999	1.000
CR02 CR03	DIODE,PIN	5082-3080	H-P	4805-02-0002	2.000
CR04	DIODE,PIN	MA47980	M-A	4805-02-0001	1.000
CR05	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	1.000
CR06 CR07	DIODE,SIGNAL	1N914	G-E	4807-01-0914	2.000
K01	RELAY,DPDT,12V	712-12	TELRY	4510-00-0015	1.000
L01 L10	CHOKE,COATED,47UH	08N470	JEF	1810-03-0470	2.000
L03 L06 L07 L08 L09	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	5.000
L04	TOROID,4T,1-1/4L	LA009-004-1	W-I	1810-05-0003	1.000
L11	CHOKE,COATED,33UH	08N330	JEF	1810-03-0330	1.000
L22	RF CHOKE,REF ONLY	CHOKE	W-I	1819-99-9999	1.000
Q01	TRANS QB000-034	BFR94	APX	4902-00-0940	1.000
Q02	TRANS QA039-040	2N3904	NAT	4901-03-9040	1.000
R01*	RES,C,1/4W,5%,120	CF1/4-120	ASE	4700-15-1200	1.000
R02	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000
R05	RES,C,1/2W,5%,470	CF1/2-470	ASE	4700-25-4700	1.000
R06	RES,C,1/8W,5%,1K RC101-210	CF1/8-1K	ASE	4700-05-1001	1.000
R07 R08 R09	RES,C,1/4W,5%,56	CF1/4-56	ASE	4700-15-5609	3.000
R10	RES,C,1/4W,5%,160	CF1/4-160	ASE	4700-15-1600	1.000
R14	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	1.000
R16*	RES,C,1/8W,5%,120	CF1/8-120	ASE	4700-05-1200	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R17	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	1.000
R18	RES,C,1/4W,5%,220	CF1/4-220	ASE	4700-15-2200	1.000
R19	RES,C,1/4W,5%,4.3K	CF1/4-4.3K	ASE	4700-15-4301	1.000
R20	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	* ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C101* C105* C109*	CAP,CHIP,1PF,100V CC101-R10	03C109CT	RPBLC	1510-00-0010	3.000
C102 C103 C106 C107 C110 C111 C115 C116 C117	CAP.,CHIP,.1 MF	51C1209-B104Z	CFI	1510-00-3104	9.000
C104*	CAP,DISC,1KV,1200PF	5GA-D12	SPR	1510-10-1122	1.000
C108 C113 C114	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	3.000
C118*	CAP,VALUE DETERMINED IN CALIBRATION	CAP,TRIM	W-I	1519-99-9999	1.000
L101 L102 L103	CHOKE,COATED,33UH	08N330	JEF	1810-03-0330	3.000
L104	CHOKE.COATED,.22UH	08NR22	JEF	1810-03-0228	1.000
Q101 Q102	TRANS MCRWV	NE02135	NEC	4902-02-1350	2.000
Q103	TRANS,200MW,2GHZ	NE41635D	NEC	4902-41-6354	1.000
R101 R108 R115	RES,C,1/8W,5%,1K RC101-210	CF1/8-1K	ASE	4700-05-1001	3.000
R102 R106 R109 R113 R116 R120	RES,C,1/8W,5%,120	CF1/8-120	ASE	4700-05-1200	6.000
R103 R104 R110 R111 R117 R118	RES,C,1/8W,5%,24	CF1/8-24	ASE	4700-05-2409	6.000
R105 R112	RES,C,1/8W,5%,6.8K	CF1/8-6.8K	ASE	4700-05-6801	2.000
R107 R114	RES,C,1/4W,5%,470	CF1/4-470	ASE	4700-15-4700	2.000
R119*	RES,C,1/8W,5%,4.7K	CF1/8-4.7K	ASE	4700-05-4701	1.000
R121 R122	RES,C,1/4W,5%,390	CF1/4-390	ASE	4700-15-3900	2.000
R123	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C201	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C203	CAP,DISC,1KV,270PF	60U271M	MDC	1510-10-1271	1.000
C204	CAP,DISC,1KV,100PF	60U101M	MDC	1510-10-1101	1.000
C205 C206	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
C207	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	1.000
C208	CAP,DISC,100V,.05UF	TG-S50	SPR	1510-10-2503	1.000
CR201	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	1.000
CR202 CR203 CR204	DIODE,SIGNAL	1N914	G-E	4807-01-0914	3.000
IC201	OP AMP, DUAL, 10 MHZ	XR-5533AP	EXAR	7000-55-3300	1.000
Q201	TRANS QA039-060	2N3906	T-I	4901-03-9060	1.000
R201	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
R202 R203	RES,C,1/4W,5%,560K	CF1/4-560K	ASE	4700-15-5603	2.000
R204	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	1.000
R206	RES,C,1/4W,5%,18K	CF1/4-18K	ASE	4700-15-1802	1.000
R207 R208 R213 R214	RES,C,1/4W,5%,22K	CF1/422K	ASE	4700-15-2202	4.000
R209	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	1.000
R210	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000
R211	RES,C,1W,5%,20	GB2005	AB	4700-35-2009	1.000
R212	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A02	MECH,C,M10W-10	MECH-C-M10W-10	W-I	1216-00-0085	1.000
C08 C09 C14 C15 C25	CAP,FT,250V,100PF	4420-100PF	AER	1510-30-3101	5.000
J01 J02 J03 J04 J05	CONN JF000-005	37JR116-1	S-C	2110-03-0002	5.000

WAVETEK PARTS LIST	MECH,L,M10W-17	1216-00-0148 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C11 C12 C16 C24 C26	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	5.000
C17	CAP,FT,500V,6.8PF	54-794-010-6892	SPEC	1510-30-1689	1.000

WAVETEK PARTS LIST	MECH,B,M10W-17	1216-00-0146 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
2	CAN,M,MOD	A000-304	W-I	1410-00-0550	1.000
6	INDEX STUD	A001-009	W-I	1410-00-2680	1.000
7	SCW,SBH,6-32X3/16	6-32X3/16,BH,NP	S-S	2810-17-6103	1.000
A01	PC ASSY,M44-1	M44-1-PC	W-I	1218-00-1561	1.000
CR01 CR02	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	2.000
J01 J02 J03 J04 J05	CONN JF000-005	37JR116-1	S-C	2110-03-0002	5.000
L01	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	1.000
L02 L05	TOROID,10T	LA009-010	W-I	1810-05-0002	2.000
L03 L04	TOROID,10T,1-1/2L	LA009-010-2	W-I	1810-05-0005	2.000

WAVETEK PARTS LIST	FM DSCRMNTR,M44-1	1114-00-0452 PAGE: 1	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
9	IC SKT,PC,14 PIN MC000-073	C931402	T-I	2112-00-0011	3.000
10	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	3.000
C01 C03 C35 C36	CAP,DISC,1KV,.005UF	5GA-D50	SPR	1510-10-1502	4.000
C04 C06	CAP,ELEC,25V,100UF	RE100M25V	ELNA	1510-26-3101	2.000
C10 C13 C8	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	3.000
C12	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	1.000
C14 C15 C16 C18	CAP,MICA,500V,270PF	DM15-271J	ARC	1510-50-0271	4.000
C17 C19 C23 C24 C29 C30	CAP,MON,50V,1UF	3420-050-E105M	AER	1510-11-3105	6.000
C20* C25* C28*	CAP,VALUE DETERMINED IN CALIBRATION	CAP,TRIM	W-I	1519-99-9999	3.000
C21 C26 C34	CAP,FILM,80V,.01UF	192P1039R8	SPR	1510-60-3103	3.000
C22	CAP,MICA,500V,.001UF	DM15-102J	ARC	1510-50-0102	1.000
C27	CAP,MICA,500V,2000PF	DM19-202J	ARC	1510-50-0202	1.000
C31 C32	CAP,DISC,1KV,6.8PF	60C0H6R8D	MDC	1510-10-0689	2.000
CR03 CR04	DIODE,SIGNAL	1N914	G-E	4807-01-0914	2.000
IC1 IC2	IC,IC000-023	SN7405N	T-I	8000-74-0500	2.000
IC3	PHASE DETECTOR	MC4044P	MOT	8000-40-4400	1.000
IC4 IC5 IC6	IC,IC000-030	LM318N	NAT	7000-03-1800	3.000
IC7	VOLT REG,+5V	78M05U1C	FCD	7000-78-0500	1.000
Q01 Q02	TRANS QA039-040	2N3904	NAT	4901-03-9040	2.000
R01 R08 R11 R15 R16 R38 R41	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	7.000
R02	RES,C,1/4W,5%,27K	CF1/4-27K	ASE	4700-15-2702	1.000
R3	RES,C,1/4W,5%,680	CF1/4-680	ASE	4700-15-6800	1.000
R04	RES,C,1/4W,5%,39K	CF1/4-39K	ASE	4700-15-3902	1.000
R5	RES,C,1/4W,5%,5.6K	CF1/4-5.6K	ASE	4700-15-5601	1.000
R07 R09 R10 R12 R26	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	5.000
R13	RES,C,1/4W,5%,8.2K	CF1/4-8.2K	ASE	4700-15-8201	1.000
R14 R32 R36	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	3.000
R20 R21 R22 R23	RES,C,1/4W,5%,2K	CF1/4-2K	ASE	4700-15-2001	4.000
R24 R25 R6	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	3.000
R27	RES,MF,1/8W,1%,1K	RN55D-1K	MILSP	4701-03-1001	1.000
R28	POT,10K,RP130-310	89PR10K	BEK	4610-00-2103	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R29	RES,MF,1/8W,1%,4.99K	RN55D-4.99K	MILSP	4701-03-4991	1.000
R30	RES,MF,1/8W,1%,4.87K	RN55D-4.87K	MILSP	4701-03-4871	1.000
R31	RES,MF,1/8W,1%,825	RN55D-825	MILSP	4701-03-8250	1.000
R33 R34	RES,MF,1/8W,1%,3.01K	RN55D-3.01K	MILSP	4701-03-3011	2.000
R35	RES,MF,1/8W,1%,1.50K	RN55D-1.50K	MILSP	4701-03-1501	1.000
R37	POT,CONT,100K	360T104B	CTS	4610-00-3104	1.000
R39	RES,C,1/4W,5%,510	CF1/4-510	ASE	4700-15-5100	1.000
R40	RES,C,1/4W,5%,1.5K	CF1/4-1.5K	ASE	4700-15-1501	1.000
R42	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C02 C05 C07 C09 C11	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	5.000
C33	CAP,FT,500V,6.8PF	54-794-010-6892	SPEC	1510-30-1689	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	>< ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MECH,L,M33-2	MECH-L-M33-2	W-I	1216-00-0089	1.000
C02*	CAP,COMP,500V,2.4PF	QC-2.4PF	Q-C	1510-40-0249	1.000
C03 C05 C24 C31 C43	CAP,DISC,100V,.005UF	TG-D50	SPR	1510-10-2502	5.000
C04 C11 C15 C26 C27 C30 C32	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	7.000
C12	CAP,DISC,1KV,470PF	60U471M	MDC	1510-10-1471	1.000
C13	CAP,DISC,1KV,33PF	10TU-Q33	SPR	1510-10-3330	1.000
C14 C18 C19 C37	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	4.000
C16 C42	CAP,DISC,100V,.05UF	TG-S50	SPR	1510-10-2503	2.000
C17 C35 C36	CAP,DISC,1KV,.002UF	5GAD20	SPR	1510-10-1202	3.000
C22	CAP,ELEC,12V,100UF	ME4D100	ARC	1510-21-2101	1.000
C25	CAP,ELEC,6V,100UF	ME3B100	ARC	1510-21-1101	1.000
C38 C39	CAP,MON,50V,4.7UF	C350C475M5U1CA	UNCAR	1510-11-3475	2.000
C40	CAP,DISC,100V,.1UF	TGP-10	SPR	1510-10-2104	1.000
C44	CAP,DISC,1KV,100PF	60U101M	MDC	1510-10-1101	1.000
CR03	DIODE,SCHOTTKY	5082-2835	H-P	4809-02-0002	1.000
CR04	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	1.000
CR05 CR06 CR07 CR08 CR11 CR12 CR13 CR14 CR15	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	9.000
CR10	DIODE,ZENER,4.7V	1N4732	MOT	4801-01-4732	1.000
IC01	OP AMP LO NOISE	NE5534AN	SIG	7000-55-3401	1.000
IC02	DUAL OP AMP	TL082CP	T-I	7000-00-8200	1.000
IC03 IC09	DUAL OP AMP,RAY ONLY	RC4558NB-RAY	RAY	7000-45-5801	2.000
IC04	VOLT REG,+5V	78M05U1C	FCD	7000-78-0500	1.000
IC05	IC,ID001-001 STATIC SENSITIVE	MC14553BCL	MOT	8001-45-5300	1.000
IC06	IC,IC000-023	SN7405N	T-I	8000-74-0500	1.000
IC07 IC08	PHASE DETECTOR	MC4044P	MOT	8000-40-4400	2.000
L01 L02 L05 L06	CHOKE,COATED,3.3UH	08N3R3	JEF	1810-03-0339	4.000
L03 L08 L09 L10 L11 L12 L13	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	7.000
L07	TOROID,4T,1-1/4L	LA009-004-1	W-I	1810-05-0003	1.000
Q01	TRANS QA039-040	2N3904	NAT	4901-03-9040	1.000
Q04	TRANS QA054-610	2N5461	MOT	4901-05-4610	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
Q05	TRANS QA054-580	2N5458	MOT	4901-05-4580	1.000
R02 R05	RES,C,1/4W,5%,56	CF1/4-56	ASE	4700-15-5609	2.000
R03 R41 R43 R44 R45 R46	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	6.000
R06	RES,C,1/4W,5%,47K	CF1/4-47K	ASE	4700-15-4702	1.000
R07 R26	RES,C,1/4W,5%,2.7K	CF1/4-2.7K	ASE	4700-15-2701	2.000
R08 R48	RES,C,1/4W,5%,7.5K	CF1/4-7.5K	ASE	4700-15-7501	2.000
R09	RES,C,1/4W,5%,390	CF1/4-390	ASE	4700-15-3900	1.000
R10	POT,100	91AR100	BEK	4610-00-7101	1.000
R17	RES,C,1/4W,5%,1.2K	CF1/4-1.2K	ASE	4700-15-1201	1.000
R18	RES,MF,1/8W,1%,619	RN55D-619	MILSP	4701-03-6190	1.000
R19	RES,MF,1/8W,1%,2.74K	RN55D-2.74K	MILSP	4701-03-2741	1.000
R20 R30 R32 R49 R61 R62	RES,C,1/4W,5%,100K	CF1/4-100K	ASE	4700-15-1003	6.000
R21	RES,C,1/4W,5%,15K	CF1/4-15K	ASE	4700-15-1502	1.000
R22 R28 R29 R50	RES,C,1/4W,5%,10K	CF1/4-10K	ASE	4700-15-1002	4.000
R23 R70	POT,20KRP156-320	43P203-6-1-0	SPE	4610-00-5203	2.000
R24	RES,C,1/4W,10%,2.2M RC104-522AB	CB2251	A-B	4705-16-2204	1.000
R25 R4 R55	RES,C,1/4W,5%,2.2K	CF1/4-2.2K	ASE	4700-15-2201	3.000
R27 R34 R38 R66	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	4.000
R31 R33 R63 R64	RES,C,1/4W,5%,180K	CF1/4-180K	ASE	4700-15-1803	4.000
R35	RES,C,1/4W,5%,820	CF1/4-820	ASE	4700-15-8200	1.000
R37	RES,C,1/4W,5%,39K	CF1/4-39K	ASE	4700-15-3902	1.000
R39 R42 R51 R52 R53 R54 R67	RES,C,1/4W,5%,27K	CF1/4-27K	ASE	4700-15-2702	7.000
R40	RES,C,1/4W,5%,270	CF1/4-270	ASE	4700-15-2700	1.000
R47	RES,C,1/4W,5%,33K	CF1/4-33K	ASE	4700-15-3302	1.000
R56 R57	RES,C,1/4W,5%,12K	CF1/4-12K	ASE	4700-15-1202	2.000
R58	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	1.000
R59 R60	RES,C,1/4W,5%,470K	CF1/4-470K	ASE	4700-15-4703	2.000
R65	RES,C,1/4W,5%,6.8K	CF1/4-6.8K	ASE	4700-15-6801	1.000
R68 R69	RES,C,1/4W,5%,150K	CF1/4-150K	ASE	4700-15-1503	2.000
R72	RES,C,1/4W,5%,13K	RCF-13K-QB	CII	4700-15-1302	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MECH,B,M33-2	MECH-B-M33-2	W-I	1216-00-0090	1.000
C04 C10	CAP,FT,500V,150PF	4420-150PF	AER	1510-31-2151	2.000
C45	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	1.000
CR01 CR02	DIODE,PIN	MA47980	M-A	4805-02-0001	2.000
CR09	LED,RED,T-1-3/4	NSL5046	NAT	4810-02-0001	1.000
CR16 CR17 CR18	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	3.000
J01 J02 J03 J04 J05	CONN JF000-005	37JR116-1	S-C	2110-03-0002	5.000
Q02	TRANS QA050-530	2N5053	APX	4901-05-0530	1.000
R01	RES,C,1/4W,5%,56	CF1/4-56	ASE	4700-15-5609	1.000

WAVETEK PARTS LIST	MECH,L,M33-2	1216-00-0089 PAGE: 1	C REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C20 C21	CAP,FT,500V,6.8PF	54-794-010-6872	SPEC	1510-30-1689	3.000
C23 C28 C29 C33 C34	CAP,FT,500V,1000PF	54-794-010-102P	SPEC	1510-30-8102	5.000
C41	CAP,FT,500V,120PF	54-794-001-121K	SPEC	1510-30-1121	1.000

WAVETEK PARTS LIST	MECH,B,M33-2	1216-00-0090 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	PC ASSY,F,M115	M115-FPC	W-I	1218-00-1451	1.000
A02	PC ASSY,R,M115	M115-RPC	W-I	1218-00-1461	1.000
A03	MECH,L,M115	MECH-L-M115	W-I	1216-00-0092	1.000
CR105	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	1.000
L111 L114 L201 L202 L204 L206	TOROID,10T,1L	LA009-010-3	W-I	1810-05-0006	6.000
Q203	TRANS QA051-090	2N5109	SSS	4901-05-1090	1.000
Q204	XSTOR,POWER,PNP	MM4018	MOT	4902-04-0180	1.000
R113	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	1.000
T101 T102	RF XFMR FROM:1813-00-0007	1210-40-0017	W-I	1210-40-0017	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
56	PC BOARD,Z448I FROM:3210-05-0048	Z448I	W-I	1710-00-0870	1.000
63	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	1.000
C201 C202 C207 C208 C218	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	5.000
C203 C206 C213 C214	CAP,ELEC,25V,100UF	TE1211	SPR	1510-20-4101	4.000
C204 C211	CAP,VARI,7.35PF,250V CV101-035	7STRIKO-02	STR	1510-70-0350	2.000
C205 C212	CAP,DISC,1KV,25PF	60C0G250J	MDC	1510-10-0250	2.000
C209 C210	CAP,TANT,25V,1UF	100DE105K25A2	ACI	1510-21-7010	2.000
C215	CAP,DISC,1KV,360PF	60U361M	MDC	1510-10-1361	1.000
C216	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C217	CAP,DISC,1KV,33PF	10TCC-Q33	SPR	1510-10-0330	1.000
CR201 CR202	DIODE,ZENER,12V	1N4742A	MOT	4801-02-0003	2.000
IC201	OP AMP LO NOISE	NE5534AN	SIG	7000-55-3401	1.000
L203	CHOKE,COATED,2.2UH	08N2R2	JEF	1810-03-0229	1.000
L205	CHOKE,COATED,4.7UH	08N4R7	JEF	1810-03-0479	1.000
Q201	TRANS QA039-040	2N3904	NAT	4901-03-9040	1.000
Q202	XSTOR,POWER,NPN	2N6715	NAT	4902-09-2011	1.000
R201	RES,C,1/4W,5%,750	CF1/4-750	ASE	4700-15-7500	1.000
R202	RES,C,1/4W,5%,1.8K	CF1/4-1.8K	ASE	4700-15-1801	1.000
R203	RES,C,1/4W,5%,33	CF1/4-33	ASE	4700-15-3309	1.000
R204	RES,C,1/4W,5%,150	CF1/4-150	ASE	4700-15-1500	1.000
R205 R212 R213	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	3.000
R206 R209	RES,C,1W,5%,75	GB7505	A-B	4700-35-7509	2.000
R207	RES,C,1/2W,5%,330	CF1/2-330	ASE	4700-25-3300	1.000
R208	RES,C,1W,5%,1K	GB1025	A-B	4700-35-1001	1.000
R210 R214	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	2.000
R211 R215	RES,C,1/2W,5%,27	EB2705	A-B	4700-25-2709	2.000
R216	RES,C,1/4W,5%,1.5K	CF1/4-1.5K	ASE	4700-15-1501	1.000
R217	RES,L-A,1/4W,1%,49.9	SPS-N-347-49.9	IRC	4741-49-9007	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
55	PC BOARD, Z447E FROM:3210-05-0047	Z447E	W-I	1710-00-0830	1.000
62	IC SKT,16 PIN MC000-074	DILB-16P-108	BURND	2112-00-0012	1.000
64	IC SKT,PC,14 PIN MC000-073	C931402	T-I	2112-00-0011	1.000
C101	CAP,DISC,1KV,330PF	10TCU-T33	SPR	1510-10-3331	1.000
C102	CAP,DISC,1KV,150PF	60U151M	MDC	1510-10-1151	1.000
C103	CAP,MICA,500V,1500PF	DM19-152J	ARC	1510-50-0152	1.000
C104	CAP,DISC,1KV,270PF	60U271M	MDC	1510-10-1271	1.000
C105 C112	CAP,VARI,7.35PF,250V CV101-035	7STRIK0-02	STR	1510-70-0350	2.000
C106	CAP,DISC,1KV,100PF	60U101M	MDC	1510-10-1101	1.000
C107 C108 C109	CAP,DISC,1KV,.001UF	5GA010	SPR	1510-10-1102	3.000
C110 C111	CAP,DISC,1KV,20PF	60C0G200J	MDC	1510-10-0200	2.000
C113 C114	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
CR101 CR102 CR103 CR104	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	4.000
IC101	13-INPUT NAND	74S133	FCD	3007-41-3300	1.000
IC102	IC,IC000-023	SN7405N	T-I	3000-74-0500	1.000
L101	CHOKE,COATED,.39UH	08NR39	JEF	1810-03-0398	1.000
L102	CHOKE,COATED,1UH	08N1R0	JEF	1810-03-0010	1.000
L103	CHOKE,COATED,3.9UH	08N3R9	JEF	1810-03-0399	1.000
L104 L108	CHOKE,COATED,10UH	08N100	JEF	1810-03-0100	2.000
L105	CHOKE,COATED,.68UH	08NR68	JEF	1810-03-0688	1.000
L106 L109	CHOKE,COATED,4.7UH	08N4R7	JEF	1810-03-0479	2.000
L107	CHOKE,COATED,2.2UH	08N2R2	JEF	1810-03-0229	1.000
L110	CHOKE,COATED,6.8UH	08N6R8	JEF	1810-03-0689	1.000
Q101	XSTOR,POWER,NPN	2N6715	NAT	4902-09-2011	1.000
R101	RES,L-A,1/4W,1%,61.1	SPS-N-347-61.1	IRC	4741-61-1007	1.000
R102	RES,L-A,1/4W1%,247.5	SPS-N-347-247.5	IRC	4741-24-7508	1.000
R103	RES,VAR.CERMET,100101	89PR100	BEK	4610-00-2101	1.000
R104	RES,C,1/2W,5%,330	CF1/2-330	ASE	4700-25-3300	1.000
R105	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	1.000
R106	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	X	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R107	RES,C,1/4W,5%,100		CF1/4-100	ASE	4700-15-1000	1.000
R108 R109 R110 R114	RES,C,1/4W,5%,1K		CF1/4-1K	ASE	4700-15-1001	4.000
R111	RES,C,1/4W,5%,4.7K		CF1/4-4.7K	ASE	4700-15-4701	1.000
R112	RES,C,1/4W,5%,47		CF1/4-47	ASE	4700-15-4709	1.000

WAVETEK PARTS LIST	PC ASSY,R,M115	1219-00-1481 PAGE: 2	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	X	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MECH,B,M115		MECH-B-M115	W-I	1216-00-0093	1.000
C17 C18	CAP,TANT,25V,10UF		100DE106M20C2	ACI	1510-21-7100	2.000
C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33 C34	CAP,DISC,100V,,15UF		CY20A154M	C-L	1510-11-1154	16.000
IC01	VOLT REG,+5V		78M05U1C	FCD	7000-78-0500	1.000
J01 J02 J03 J04	CONN JF000-005		37JR116-1	S-C	2110-03-0002	4.000
L01	TOROID,10T		LA009-010	W-I	1810-05-0002	1.000

WAVETEK PARTS LIST	MECH,L,M115	1216-00-0092 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R107	RES,C,1/4W,5%,100	CF1/4-100	ASE	4700-15-1000	1.000
R108 R109 R110 R114	RES,C,1/4W,5%,1K	CF1/4-1K	ASE	4700-15-1001	4.000
R111	RES,C,1/4W,5%,4.7K	CF1/4-4.7K	ASE	4700-15-4701	1.000
R112	RES,C,1/4W,5%,47	CF1/4-47	ASE	4700-15-4709	1.000

WAVETEK PARTS LIST	PC ASSY,R,M115	1218-00-1461 PAGE: 2	REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	MECH,B,M115	MECH-B-M115	W-I	1216-00-0093	1.000
C17 C18	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33 C34	CAP,DISC,100V,.15UF	CY20A154M	C-L	1510-11-1154	16.000
IC01	VOLT REG,+5V	78M05U1C	FCD	7000-78-0500	1.000
J01 J02 J03 J04	CONN JF000-005	37JR116-1	S-C	2110-03-0002	4.000
L01	TOROID,10T	LA009-010	W-I	1810-05-0002	1.000

WAVETEK PARTS LIST	MECH,L,M115	1216-00-0092 PAGE: 1	A REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
55	PC BOARD, Z447E FROM:3210-05-0047	Z447E	W-I	1710-00-0830	1.000
62	IC SKT,16 PIN MC000-074	DILB-16P-108	BURND	2112-00-0012	1.000
64	IC SKT,PC,14 PIN MC000-073	C931402	T-I	2112-00-0011	1.000
C101	CAP,DISC,1KV,330PF	10TCU-T33	SPR	1510-10-3331	1.000
C102	CAP,DISC,1KV,150PF	60U151M	MDC	1510-10-1151	1.000
C103	CAP,MICA,500V,1500PF	DM19-152J	ARC	1510-50-0152	1.000
C104	CAP,DISC,1KV,270PF	60U271M	MDC	1510-10-1271	1.000
C105 C112	CAP,VARI,7.35PF,250V CV101-035	7STRIKO-02	STR	1510-70-0350	2.000
C106	CAP,DISC,1KV,100PF	60U101M	MDC	1510-10-1101	1.000
C107 C108 C109	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	3.000
C110 C111	CAP,DISC,1KV,20PF	60C0G200J	MDC	1510-10-0200	2.000
C113 C114	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
CR101 CR102 CR103 CR104	DIODE,SCHOTTKY	5082-2800	H-P	4809-02-0001	4.000
IC101	13-INPUT NAND	74S133	FCD	8007-41-3300	1.000
IC102	IC,IC000-023	SN7405N	T-I	8000-74-0500	1.000
L101	CHOKE,COATED,.39UH	08NR39	JEF	1810-03-0398	1.000
L102	CHOKE,COATED,1UH	08N1R0	JEF	1810-03-0010	1.000
L103	CHOKE,COATED,3.9UH	08N3R9	JEF	1810-03-0399	1.000
L104 L108	CHOKE,COATED,10UH	08N100	JEF	1810-03-0100	2.000
L105	CHOKE,COATED,.68UH	08NR68	JEF	1810-03-0688	1.000
L106 L109	CHOKE,COATED,4.7UH	08N4R7	JEF	1810-03-0479	2.000
L107	CHOKE,COATED,2.2UH	08N2R2	JEF	1810-03-0229	1.000
L110	CHOKE,COATED,6.8UH	08N6R8	JEF	1810-03-0689	1.000
Q101	XSTOR,POWER,NPN	2N6715	NAT	4902-09-2011	1.000
R101	RES,L-A,1/4W,1%,61.1	SPS-N-347-61.1	IRC	4741-61-1007	1.000
R102	RES,L-A,1/4W1%,247.5	SPS-N-347-247.5	IRC	4741-24-7508	1.000
R103	RES,VAR.CERMET,10010%	89PR100	BEK	4610-00-2101	1.000
R104	RES,C,1/2W,5%,330	CF1/2-330	ASE	4700-25-3300	1.000
R105	RES,C,1/4W,5%,3.3K	CF1/4-3.3K	ASE	4700-15-3301	1.000
R106	RES,C,1/4W,5%,330	CF1/4-330	ASE	4700-15-3300	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C01 C02 C03 C04 C05 C06 C07 C08 C09 C10 C11 C12 C13 C14 C15 C16	CAP,FT,500V,470PF	FA5C-4712	A-B	1510-30-0471	16.000

WAVETEK PARTS LIST	MECH,B,M115	1216-00-0093 PAGE: 1	B REV

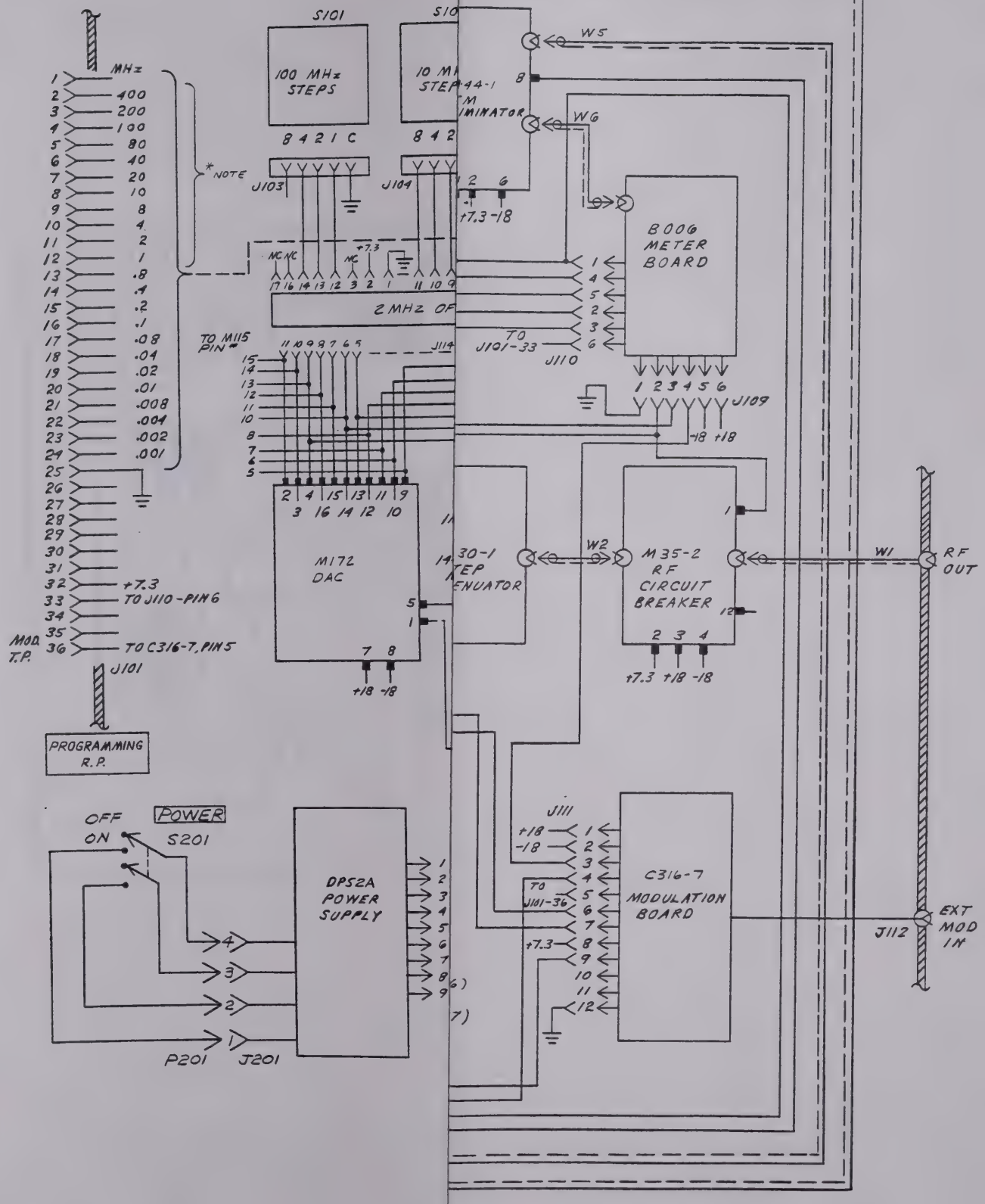
REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	PC ASSY, M29-2	M29-2-PC	W-I	1218-00-1690	1.000
A02	MECH,B,M29-2	MECH-B-M29-2	W-I	1216-00-0045	1.000
C15 C18	CAP,TANT,25V,10UF	100DE106M20C2	ACI	1510-21-7100	2.000
C27	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	1.000
J01	CONN JF000-005	37JR116-1	S-C	2110-03-0002	1.000
L01 L02	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	2.000
R44	RES,MF,1/8W,1%,499	RN55D-499	MILSP	4701-03-4990	1.000
R45	RES,MF,1/8W,1%,174	RN55D-174	MILSP	4701-03-1740	1.000
R59	RES,MF,1/8W,1%,1M	RN55D-1M	MILSP	4701-03-1004	1.000
R60	RES,MF,1/8W,1%,48.7K	RN55D-48.7K	MILSP	4701-03-4872	1.000
R61	RES,MF,1/8W,1%,10K	RN55D-10K	MILSP	4701-03-1002	1.000

WAVETEK PARTS LIST	FM REF,M29-2	1114-00-0464 PAGE: 1	B REV

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C02	CAP,DISC,1KV,75PF	10TCU-Q75	SPR	1510-10-3750	1.000
C03 C05 C08 C09 C19 C24 C25 C26	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	8.000
C04 C10	CAP,DISC,1KV,150PF	60U151M	MDC	1510-10-1151	2.000
C06	CAP,DISC,1KV,.003UF	5GA-D30	SPR	1510-10-1302	1.000
C07	CAP,DISC,1KV,68PF	68U2J680J	MDC	1510-10-3680	1.000
C11	CAP,VARI,7.35PF,250V CV101-035	7STRIKO-02	STR	1510-70-0350	1.000
C12*	CAP,MICA,500V,27PF	CM05ED270J03	ARC	1510-50-0270	1.000
C13	CAP,MICA,500V,470PF	DM15-471J	ARC	1510-50-0471	1.000
C20	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C21	CAP,MICA,500V,100PF	DM15-101J	C-D	1510-50-0101	1.000
C23 C28	CAP,DISC,1KV,20PF	60C0G200J	MDC	1510-10-0200	2.000
CR01 CR10 CR11	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	3.000
CR02 CR07 CR08 CR09	DIODE,PLANAR	FD-6666	FCD	4807-02-0003	4.000
CR03 CR04 CR05 CR06	DIODE,COMPUTER	FD777	FCD	4807-02-0002	4.000
IC01 IC02	IC,8 PIN,IC000-008	LM301-AN	NAT	7000-03-0100	2.000
IC03	DUAL DIFF AMP	CA3102E	RCA	7000-31-0200	1.000
Q01	TRANS QB000-011	TD401	SPR	4902-00-4010	1.000
Q02	TRANS QB000-009	MPS3702	NAT	4902-03-7020	1.000
Q03	TRANS QB000-010	TD101	SPR	4902-00-1010	1.000
Q04	TRANS QA039-040	2N3904	NAT	4901-03-9040	1.000
Q05	TRANS QA039-060	2N3906	T-I	4901-03-9060	1.000
Q06	TRANS QR000-026	AD3958	A-D	4902-03-9580	1.000
Q07 Q10	TRANS QA051-390	2N5139	NAT	4901-05-1390	2.000
Q08 Q09	TRANS QA036-400	3640-18	NAT	4901-03-6400	2.000
R01	POT,2K,RP130-220	89PR2K	BEK	4610-00-2202	1.000
R02	RES,MF,1/8W,1%,4.87K	RN55D-4.87K	MILSP	4701-03-4871	1.000
R03 R05 R10 R16 R19 R22 R25	RES,MF,1/8W,1%,1K	RN55D-1K	MILSP	4701-03-1001	7.000
R04 R07 R38 R40	RES,MF,1/8W,1%,2K	RN55D-2K	MILSP	4701-03-2001	4.000
R06 R12 R15	RES,MF,1/8W,1%,110K	RN55D-110K	MILSP	4701-03-1103	3.000
R08 R21	RES,MF,1/8W,1%,249	RN55D-249	MILSP	4701-03-2490	2.000
R09 R14 R30 R32 R33	RES,MF,1/8W,1%,499	RN55D-499	MILSP	4701-03-4990	5.000

MODEL 3007 WIRING DIAGRAM

REV____



REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C02	CAP,DISC,1KV,75PF	10TCU-075	SPR	1510-10-3750	1.000
C03 C05 C08 C09 C19 C24 C25 C26	CAP,DISC,100V,.01UF	68U103M	MDC	1510-10-2103	8.000
C04 C10	CAP,DISC,1KV,150PF	60U151M	MDC	1510-10-1151	2.000
C06	CAP,DISC,1KV,.003UF	5GA-D30	SPR	1510-10-1302	1.000
C07	CAP,DISC,1KV,68PF	68U2J680J	MDC	1510-10-3680	1.000
C11	CAP,VARI,7.35PF,250V CV101-035	7STRIK0-02	STR	1510-70-0350	1.000
C12*	CAP,MICA,500V,27PF	CM05ED270J03	ARC	1510-50-0270	1.000
C13	CAP,MICA,500V,470PF	DM15-471J	ARC	1510-50-0471	1.000
C20	CAP,DISC,1KV,.001UF	5GAD10	SPR	1510-10-1102	1.000
C21	CAP,MICA,500V,100PF	DM15-101J	C-D	1510-50-0101	1.000
C23 C28	CAP,DISC,1KV,20PF	60C0G200J	MDC	1510-10-0200	2.000
CR01 CR10 CR11	DIODE,RECT,400V	1N4004	P-C	4806-01-4004	3.000
CR02 CR07 CR08 CR09	DIODE,PLANAR	FD-6666	FCD	4807-02-0003	4.000
CR03 CR04 CR05 CR06	DIODE,COMPUTER	FD777	FCD	4807-02-0002	4.000
IC01 IC02	IC,8 PIN,IC000-008	LM301-AN	NAT	7000-03-0100	2.000
IC03	DUAL DIFF AMP	CA3102E	RCA	7000-31-0200	1.000
Q01	TRANS QB000-011	TD401	SPR	4902-00-4010	1.000
Q02	TRANS QB000-009	MPS3702	NAT	4902-03-7020	1.000
Q03	TRANS QB000-010	TD101	SPR	4902-00-1010	1.000
Q04	TRANS QA039-040	2N3904	NAT	4901-03-9040	1.000
Q05	TRANS QA039-060	2N3906	T-I	4901-03-9060	1.000
Q06	TRANS QB000-026	AD3958	A-D	4902-03-9580	1.000
Q07 Q10	TRANS QA051-390	2N5139	NAT	4901-05-1390	2.000
Q08 Q09	TRANS QA036-400	3640-18	NAT	4901-03-6400	2.000
R01	POT,2K,RP130-220	89PR2K	BEK	4610-00-2202	1.000
R02	RES,MF,1/8W,1%,4.87K	RN55D-4.87K	MILSP	4701-03-4871	1.000
R03 R05 R10 R16 R19 R22 R25	RES,MF,1/8W,1%,1K	RN55D-1K	MILSP	4701-03-1001	7.000
R04 R07 R38 R40	RES,MF,1/8W,1%,2K	RN55D-2K	MILSP	4701-03-2001	4.000
R06 R12 R15	RES,MF,1/8W,1%,110K	RN55D-110K	MILSP	4701-03-1103	3.000
R08 R21	RES,MF,1/8W,1%,249	RN55D-249	MILSP	4701-03-2490	2.000
R09 R14 R30 R32 R33	RES,MF,1/8W,1%,499	RN55D-499	MILSP	4701-03-4990	5.000

MODEL 3007
WIRING DIAGRAM

REV____

S101 100 MHz STEPS
S102 10 MHz STEPS
S103 1 MHz STEPS
FREQUENCY
S104 100 KHz STEPS
S105 10 KHz STEPS
S106 1 KHz STEPS
8 4 2 1 C

MHz 400 200 100 80 40 20 10 8 4 2 1 .8 .4 .2 .1 .08 .04 .02 .01 .008 .004 .002 .001 +7.3 TO J110-PIN 6 TO C316-7, PINS 5
* NOTE
MOD T.P.
J101
PROGRAMMING R.P.

J103 J104 J105 J106 J107 J108
FREQUENCY PROGRAM
J113
2 MHz OFFSET BD.
TO M115 PIN #
J114

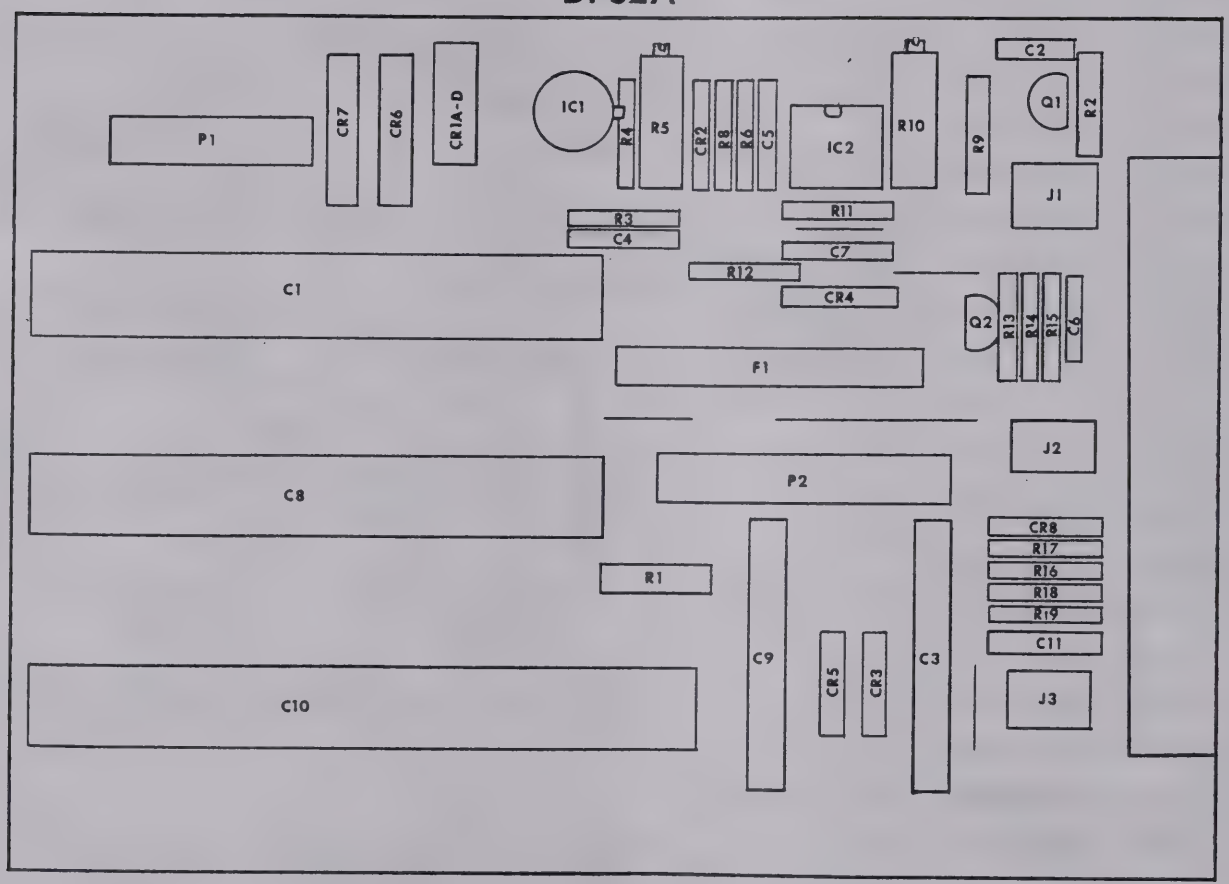
M172 DAC
M32A 1 MHz STEPS
M31A 1 KHz STEPS
M34 WIDE OSCILLATOR LOCK
40 COMB
M9W SWEEP OSCILLATOR
M115 KHz DOWN CONVERTOR
TO M172 DAC
10 MHz
M43 AMP/MIX
M44-1 FM DISCRIMINATOR
2 MHz
+7.3 +18 -18
M10W-17 OUTPUT AMPLIFIER
50130-1 STEP ATTENUATOR
M35-2 RF CIRCUIT BREAKER
B006 METER BOARD
TO J101-33
J110
J109
RF IN
RF OUT
W1 W2 W3 W4 W5 W6 W7 W8 W9 W10 W18 W19 W20 W21 W22 W23 W24
TP

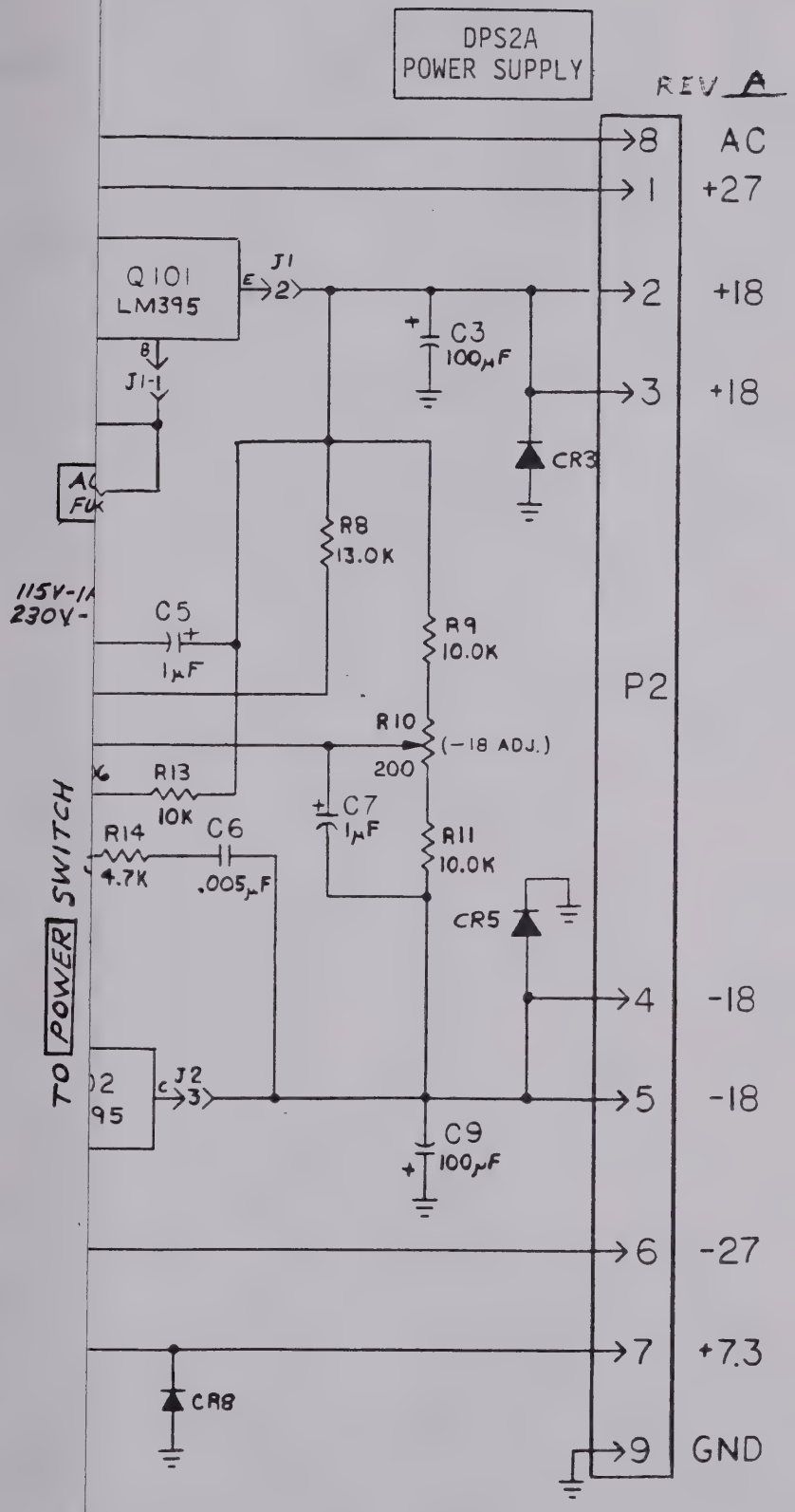
OFF ON POWER S201
DPS2A POWER SUPPLY
P201 J201
J102 +27 +18 -18 -27 +7.3

* NOTE: J101-2 TO J101-12 ARE CONNECTED TO THE 2MHz OFFSET BOARD AT J113. FOR DETAILS SEE THE 2 MHz OFFSET BOARD SCHEMATIC.

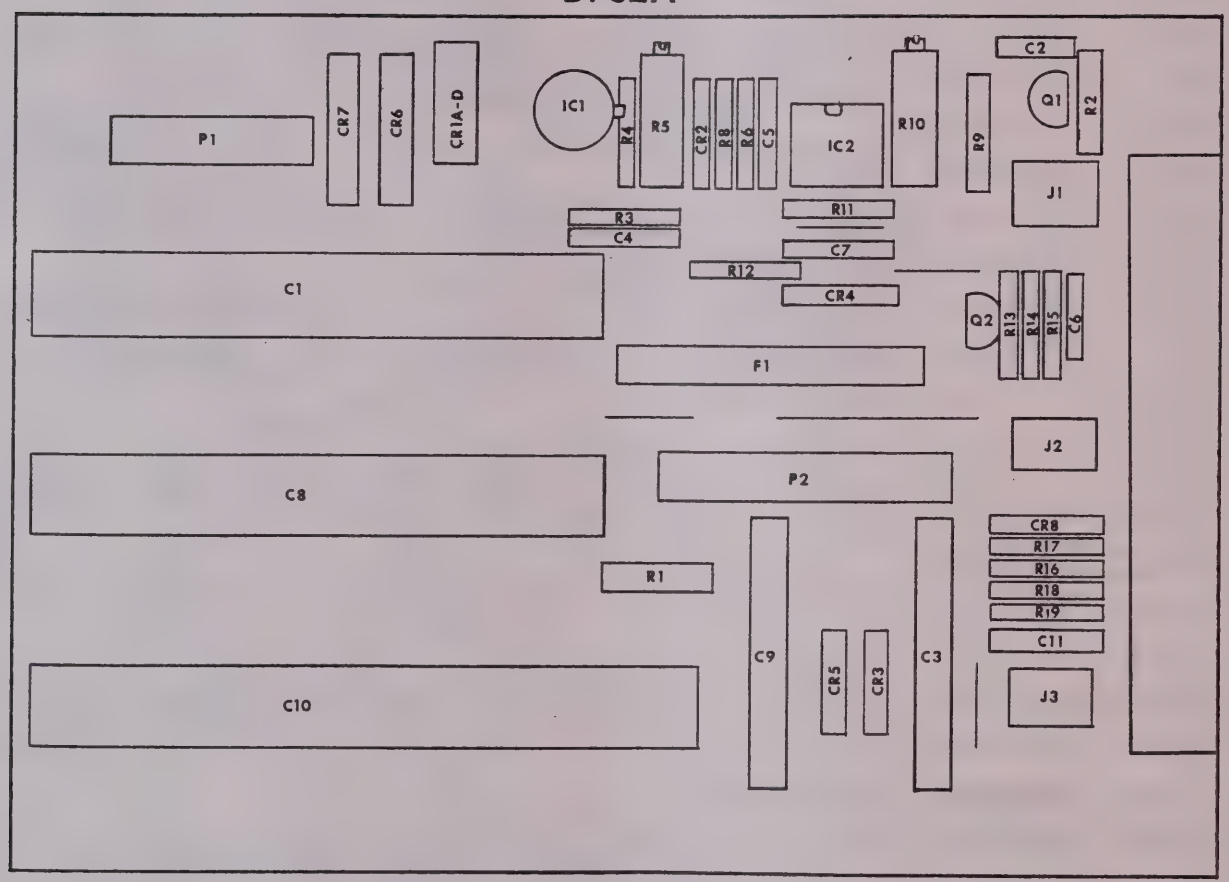
M33-2 NARROW OSCILLATOR LOCK
2KHz
120 COMB
M29-2 FM REFERENCE
M30-9 CRYSTAL REFERENCE
10 MHz (W22)
1 KHz (W11)
2 KHz (W12)
1 MHz (W13)
2 MHz (W14)
1440 MHz (W15)
40 COMB (W16)
120 COMB (W17)
J111
TO J101-36
C316-7 MODULATION BOARD
J112
EXT MOD IN

DPS2A


P1
CR7
CR6
CR1A-D
IC1
R4
R5
CR2
R8
R6
C5
IC2
R10
R9
C2
Q1
R2
J1
R3
C4
R11
C7
R12
CR4
C1
Q2
R13
R14
R15
C6
F1
J2
C8
P2
CR8
R17
R16
R18
R19
C11
R1
C9
CR5
CR3
C3
J3
C10


DPS2A
POWER SUPPLY
REV A
Q101
LM395
J1
2
J1-1
C3
100µF
CR3
R8
13.0K
R9
10.0K
C5
1µF
R10
(-18 ADJ.)
200
R13
10K
C7
1µF
R14
4.7K
C6
.005µF
R11
10.0K
CR5
TO POWER SWITCH
J2
3
C9
100µF
CR8
P2
8
AC
1
+27
2
+18
3
+18
4
-18
5
-18
6
-27
7
+7.3
9
GND

DPS2A


P1
CR7
CR6
CR1A-D
IC1
R4
R5
CR2
R8
R6
C5
IC2
R10
R9
C2
Q1
R2
J1
R3
C4
R11
C7
R12
CR4
C1
Q2
R13
R14
R15
C6
F1
J2
C8
P2
CR8
R17
R16
R18
R19
C11
R1
C9
CR5
CR3
C3
J3
C10

DPS2A
POWER SUPPLY

REV A

AC LINE
FUSE R.P.

F101
115V-1A AT
230V-.5A AT

AC LINE
115/230 R.P.

115
VIOLET
S102
BROWN
230

TO POWER SWITCH
J201
3
4
1
2

BN BU GN/YL

P202

AC LINE
PLUG R.P.

T101
BLACK
GN
RD/YL
GN
YL
WHITE
GRAY

J101 P1
RD
1
3
5
2
4

CR1A-D

F1
2A. AT

R1
4.7K

C1
1500μF
+18

C2
.005μF

R2
1K

Q1
E232

J1
3
C
Q101
LM395
E
J1
2

8
J1-1

C3
100μF

CR3

IC1
REF02
2
7
4
6

R3
39K

C4
1μF

+18
IC2A
TL082
3
2
8
1

R6
3.9K

CR2

C5
1μF

R8
13.0K

R9
10.0K

R4
4.87K

R5
500
(+18 ADJ)

R10
200
(-18 ADJ.)

TL082
IC2B
6
5
7
4

CR4

R12
4.7K

-18

2N3906
Q2

R13
10K

R14
4.7K

C6
.005μF

C7
1μF

R11
10.0K

CR5

R15
1.2K

J2
-1
8

J2
2
E
Q102
LM395
C
J2
3

C8
1500μF

C9
100μF

CR6

CR7

C10
10,000μF

J3
3
IC101
LM317
J3
2

J3
-1

R16
150

R17
*

R18
768

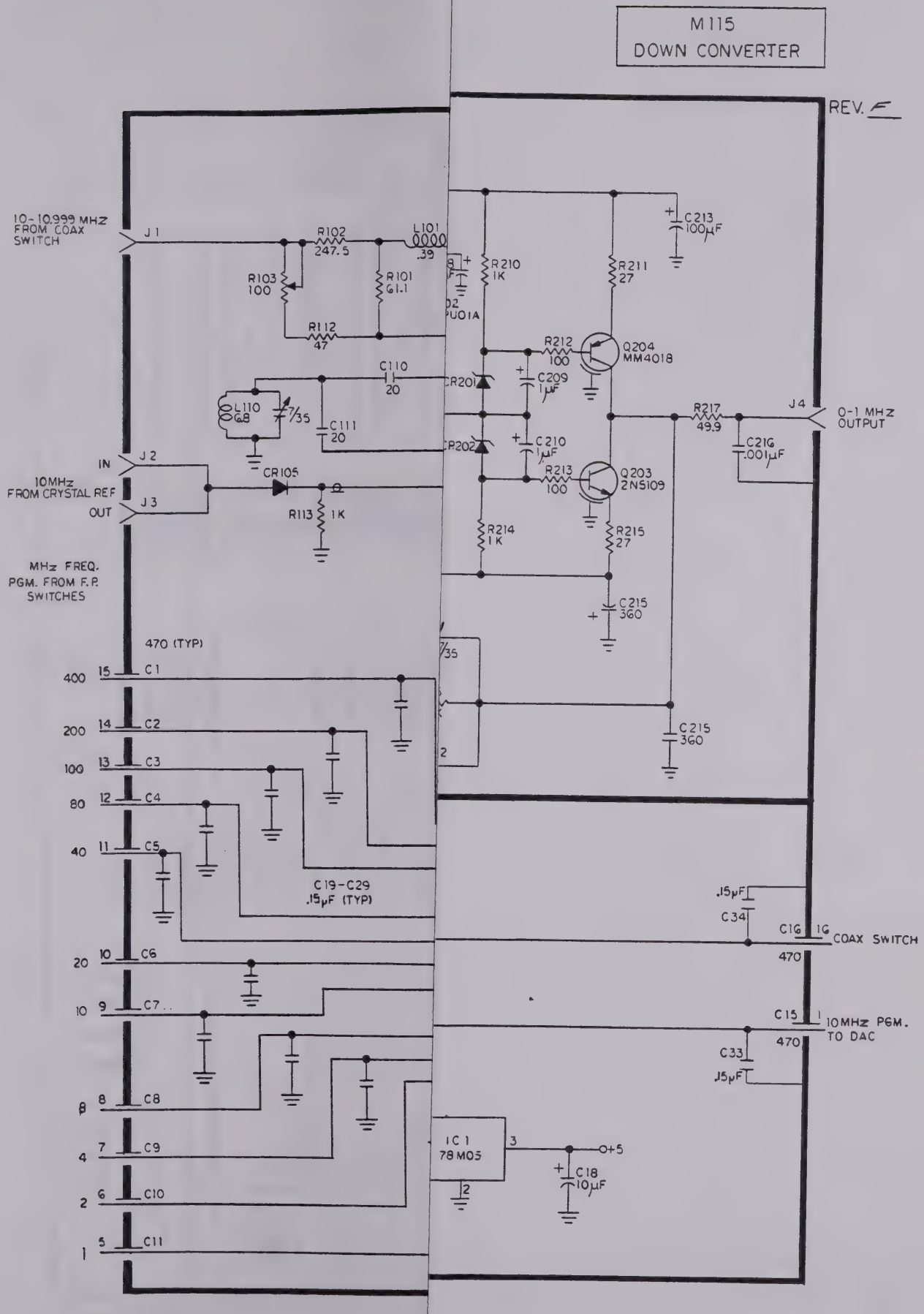
R19
*

C11
10μF

CR8

P2

8	AC
1	+27
2	+18
3	+18
4	-18
5	-18
6	-27
7	+7.3
9	GND

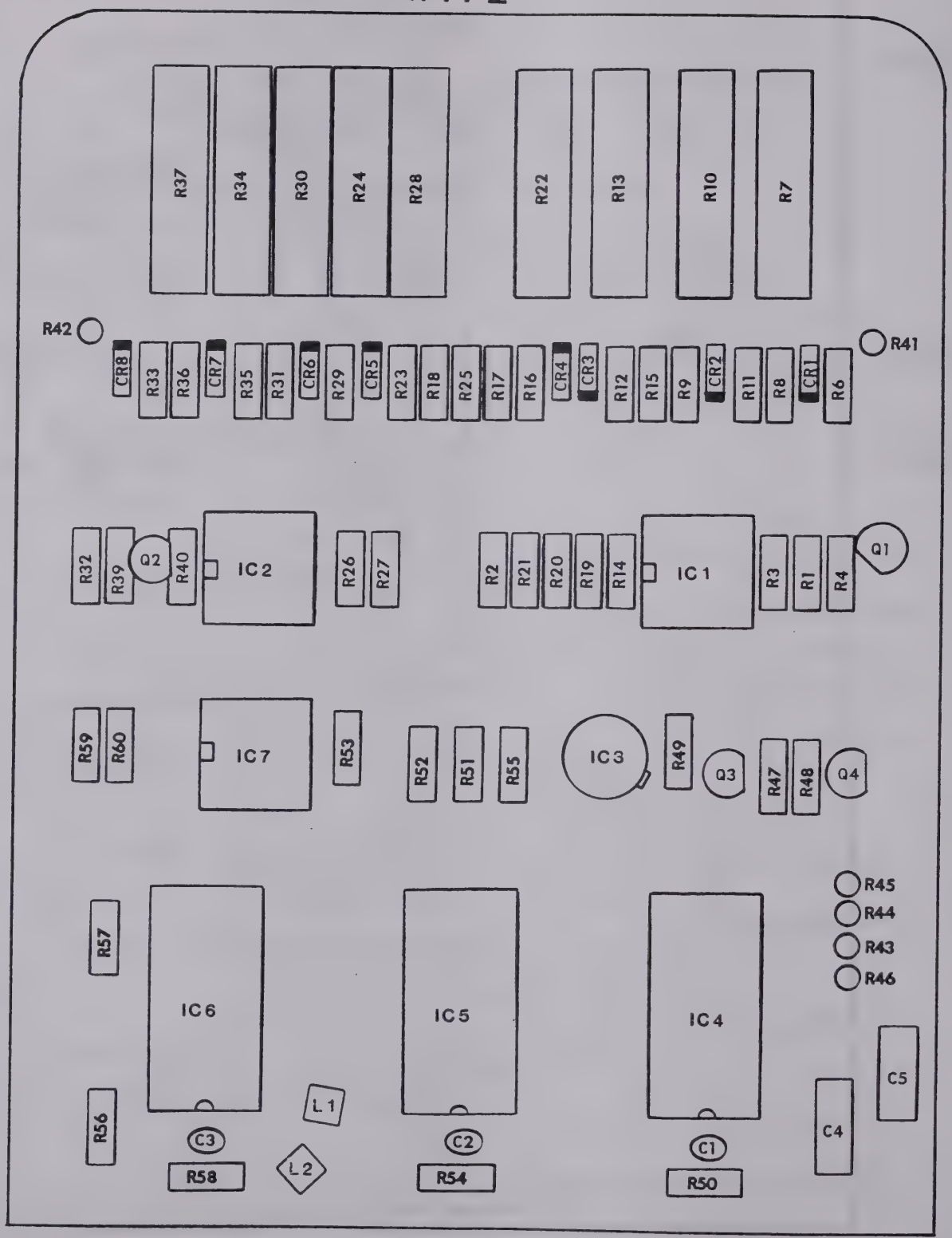

M115
DOWN CONVERTER
REV. F
10-10.999 MHZ FROM COAX SWITCH
J1
R102 247.5
L101 .39
R103 100
R101 61.1
R112 47
C110 20
L110 68
7/35
C111 20
IN
J2
10MHz FROM CRYSTAL REF
OUT
J3
CR105
R113 1K
MHz FREQ. PGM. FROM F.P. SWITCHES
470 (TYP)
400 15 C1
200 14 C2
100 13 C3
80 12 C4
40 11 C5
C19-C29 .15μF (TYP)
20 10 C6
10 9 C7
8 8 C8
4 7 C9
2 6 C10
1 5 C11
R210 1K
R211 27
C213 100μF
CR201
CR202
C209 1μF
C210 1μF
R212 100
Q204 MM4018
R213 100
Q203 2N5109
R214 1K
R215 27
C215 360
R217 49.9
J4
0-1 MHZ OUTPUT
C216 .001μF
.15μF
C34
C16 16
COAX SWITCH
470
C15 1
10MHz PGM. TO DAC
470
C33
.15μF
IC1 78M05
3
+5
C18 10μF
2

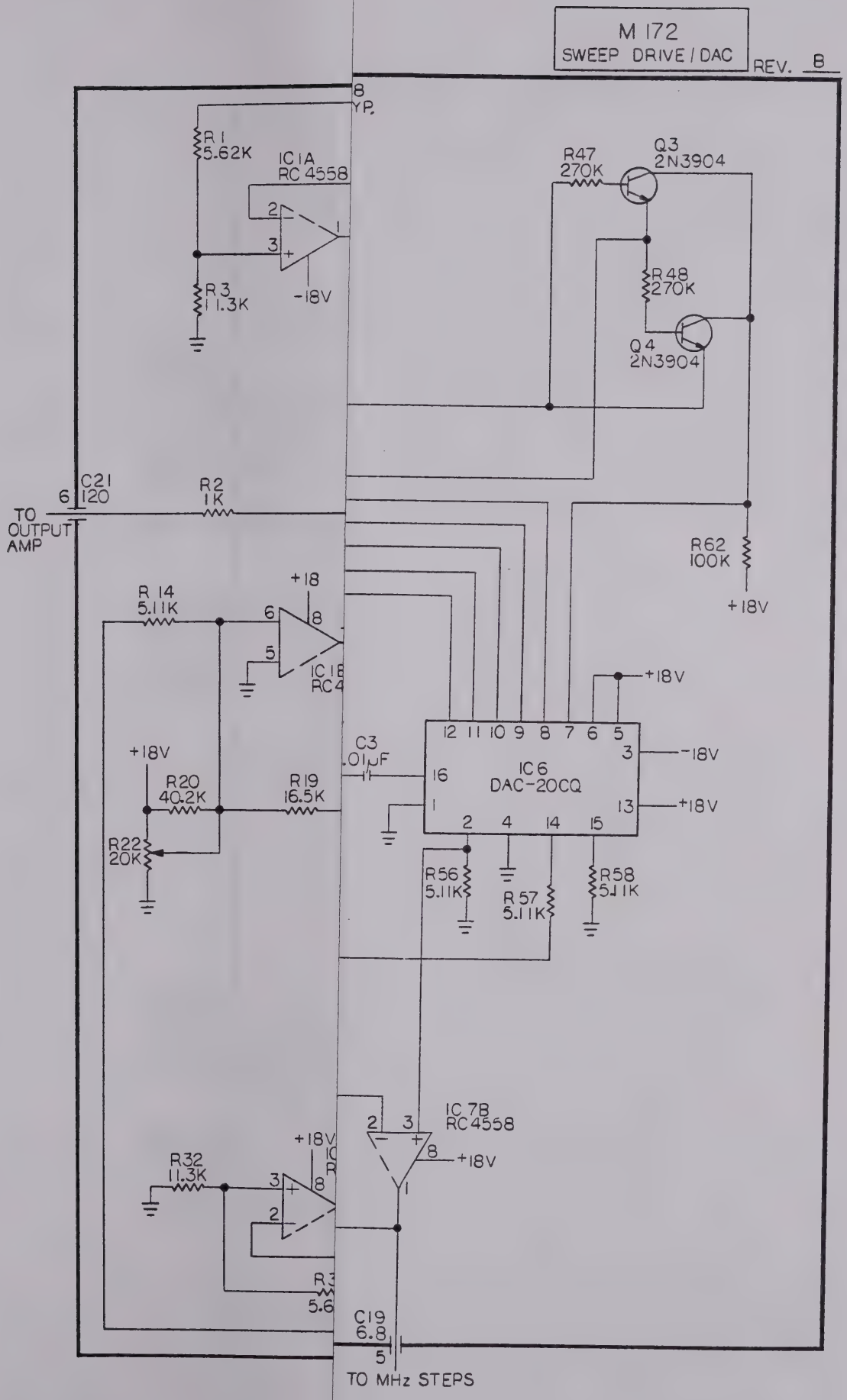
M115
DOWN CONVERTER

REV. F

10-10999 MHZ FROM COAX SWITCH
J1
R102 247.5
L101 .39
L102 1
T101
R103 100
R101 61.1
C101 330
C102 150
R112 47
CR101
CR103
CR102
CR104
T102
L103 3.9
L104 10
C103 1500
C110 20
L110 4.8
7/35
C111 20
IN J2
10MHz FROM CRYSTAL REF
OUT J3
CR105
R113 1K
+18
R104 330
C108 .001μF
L108 10
C107 .001μF
L107 2.2
L106 4.7
L105 .68
C106 100
C105 7/35
C104 270
R105 3.3K
Q101 92PU01A
L109 4.7K
R106 330
R107 100
C109 .001μF
-18
MHz FREQ. PGM. FROM F.P. SWITCHES
470 (TYP)
400 15 C1
200 14 C2
100 13 C3
80 12 C4
40 11 C5
20 10 C6
10 9 C7
8 8 C8
4 7 C9
2 6 C10
1 5 C11
C19-C29 .15μF (TYP)
+5
R114 1K
16
IC101 74S133
8
R111 4.7K
L201 10T B
C201 10μF
R201 750
2N3904 Q201
L204 10T
C207 10μF
R206 75
C213 100μF
R207 330
C218 10μF
R210 1K
R211 27
Q202 92PU01A
IC201 NE5534
C206 100μF
R204 150
L205 4.7
L203 2.2
C203 100μF
C204 7/35
C205 25
C217 33
R205 100
R208 1K
CR201
R212 100
Q204 MM4018
C209 1μF
CR202
C210 1μF
R213 100
Q203 2N5109
R214 1K
R215 27
R217 49.9
J4
0-1 MHZ OUTPUT
C216 .001μF
R202 1.8K
R203 33
L206 10T
R209 75
C202 10μF
L202 10T A
C208 10μF
C211 7/35
C215 360
R216 1.5K
C212 25
C215 360
+5
R108 1K
R109 1K
R110 1K
R111 4.7K
IC102
.15μF
C34
C16 16 COAX SWITCH
470
C15 1 10MHZ PGM. TO DAC
470
C33 .15μF
C113 10μF
L111 10T
C30 .15μF
C12 470
A
-18
-18V
C114 10μF
L114 10T
C31 .15μF
C13 470
B
+18V
C17 10μF
L1 10T
C32 .15μF
C14 470
+7.3
IC1 78M05
C18 10μF
+5

M172


R37
R34
R30
R24
R28
R22
R13
R10
R7
R42
R41
CR8
R33
R36
CR7
R35
R31
CR6
R29
CR5
R23
R18
R25
R17
R16
CR4
CR3
R12
R15
R9
CR2
R11
R8
CR1
R6
R32
R39
Q2
R40
IC2
R26
R27
R2
R21
R20
R19
R14
IC1
R3
R1
R4
Q1
R59
R60
IC7
R53
R52
R51
R55
IC3
R49
Q3
R47
R48
Q4
R45
R44
R43
R46
R57
IC6
IC5
IC4
C5
R56
L1
C3
C2
C1
C4
L2
R58
R54
R50


M 172
SWEEP DRIVE / DAC
REV. B
8 TYP.
R1 5.62K
IC1A RC4558
R3 11.3K
-18V
R47 270K
Q3 2N3904
R48 270K
Q4 2N3904
C21 .120
R2 1K
TO OUTPUT AMP
R62 100K
+18V
R14 5.11K
+18
IC1B RC4
C3 .01µF
IC6 DAC-20CQ
R20 40.2K
R19 16.5K
R22 20K
R56 5.11K
R57 5.11K
R58 5.11K
IC7B RC4558
R32 11.3K
C19 6.8
TO MHz STEPS

M172

R37
R34
R30
R24
R28
R22
R13
R10
R7
R42
R41
CR8
R33
R36
CR7
R35
R31
CR6
R29
CR5
R23
R18
R25
R17
R16
CR4
CR3
R12
R15
R9
CR2
R11
R8
CR1
R6
R32
R39
Q2
R40
IC2
R26
R27
R2
R21
R20
R19
R14
IC1
R3
R1
R4
Q1
R59
R60
IC7
R53
R52
R51
R55
IC3
R49
Q3
R47
R48
Q4
R45
R44
R43
R46
R57
IC6
IC5
IC4
C5
R56
L1
C3
L2
C2
C1
C4
R58
R54
R50

M 172
SWEEP DRIVE / DAC
REV. B

TO SWEEP OSC. 400 200 100 80 40 20 10 8 4 2 1
C20 120
C8 - C18 1000 TYP.

+18V
R1 5.62K
R4 4.02K
IC1A RC4558
Q1 2N4250
R3 11.3K
-18V
R41 10 T.P. 2
CR1
R6 330K (0 MHz)
R7 100K
R8 1K
CR2
R11 330K (50MHz)
R10 100K
R9 3.01K
CR3
R12 330K (100MHz)
R13 100K
R15 100K
CR4
R16 910K
R17 100K
R18 1K
CR5
R25 330K (350MHz)
R24 100K
R23 1K
CR6
R29 220K (400MHz)
R30 100K
R31 1K
CR7
R35 220K (450MHz)
R34 100K
R33 1K
CR8
R42 10 T.P. 1
R37 100K
R36 120K (500MHz)
R39 5.62K
R32 11.3K
IC2A RC4558
Q2 2N5088

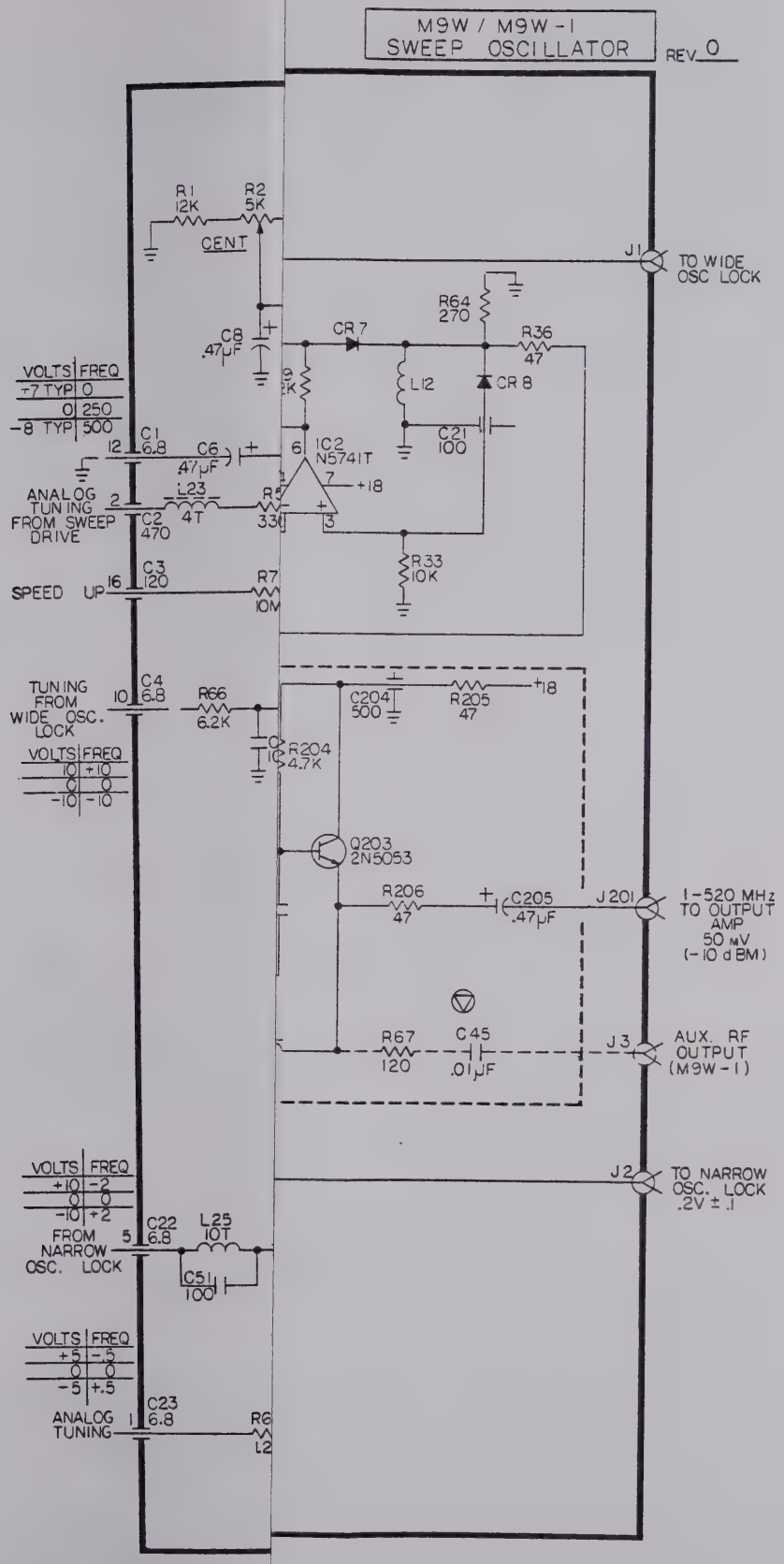
C21 120
TO OUTPUT AMP
R2 1K
R14 5.11K
IC1B RC4558
+18
R20 40.2K
R19 16.5K
R22 20K

R43 4.7K
R44 4.7K
R45 4.7K
R46 4.7K
+18V
R61 2.4K
CR9
-18V
R26 100K
R27 75K (300MHz)
R28 20K

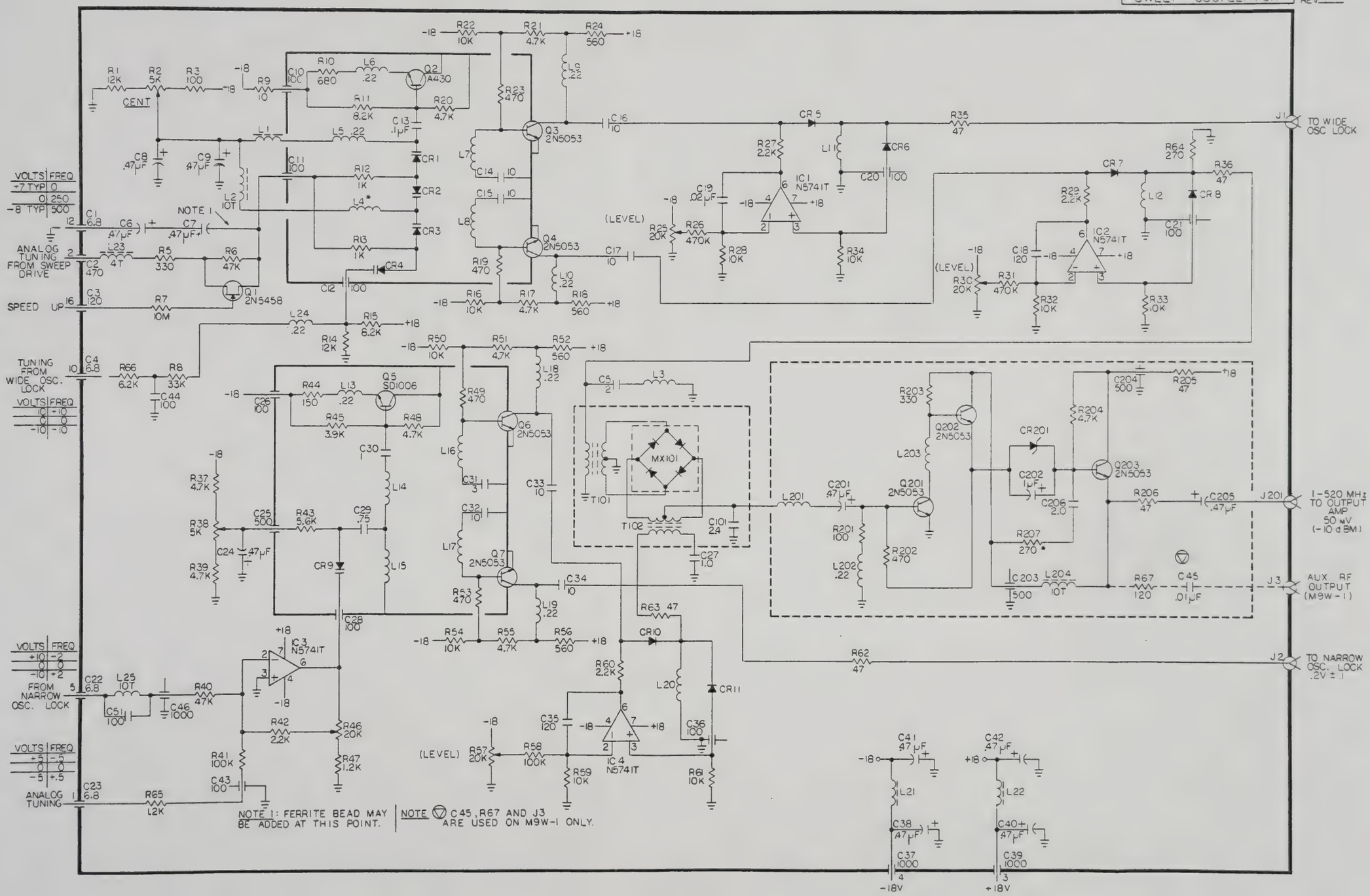
R47 270K
Q3 2N3904
R48 270K
Q4 2N3904
R62 100K
+18V

+18V
IC3 REF-01
C1 .01µF
IC4 DAC-20CQ
C2 .01µF
IC5 DAC-20CQ
C3 .01µF
IC6 DAC-20CQ
R49 5.11K
R50 5.11K
R55 48.7K
R54 5.11K
R56 5.11K
R57 5.11K
R58 5.11K
R51 5.11K
R52 2.7K
R53 2.7K
IC7A RC4558
T.P. 3
R59 5.11K
R60 5.11K
IC7B RC4558

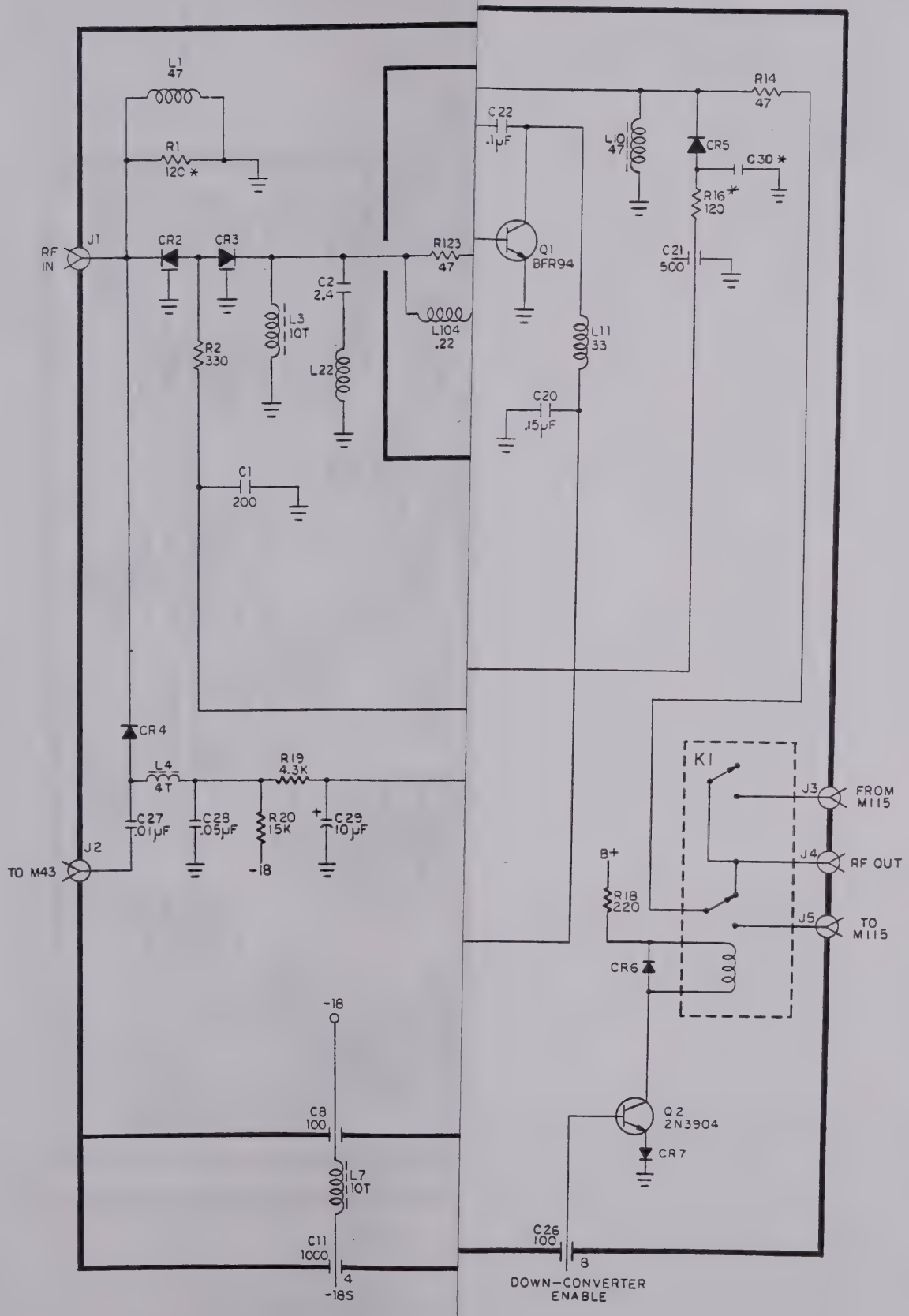
L1
L2
C4 10µF
C5 10µF
C6 1000
C7 1000
C19 6.8
TO MHz STEPS


M9W / M9W-1
SWEEP OSCILLATOR
REV. 0
R1 12K
R2 5K
CENT
J1
TO WIDE OSC LOCK
R64 270
C8 .47μF
CR7
R36 47
L12
CR8
C21 100
VOLTS | FREQ
+7 TYP | 0
0 | 250
-8 TYP | 500
C1 6.8
C6 .47μF
IC2 N5741T
+18
ANALOG TUNING FROM SWEEP DRIVE
L23 4T
C2 470
R5 33
R33 10K
SPEED UP
C3 120
R7 10M
TUNING FROM WIDE OSC. LOCK
C4 6.8
R66 6.2K
C204 500
R205 47
R204 4.7K
VOLTS | FREQ
10 | +10
0 | 0
-10 | -10
Q203 2N5053
R206 47
C205 .47μF
J201
1-520 MHz TO OUTPUT AMP 50 mV (-10 d BM)
R67 120
C45 .01μF
J3
AUX. RF OUTPUT (M9W-1)
J2
TO NARROW OSC. LOCK .2V ± .1
VOLTS | FREQ
+10 | -2
0 | 0
-10 | +2
FROM NARROW OSC. LOCK
C22 6.8
L25 10T
C51 100
VOLTS | FREQ
+5 | -.5
0 | 0
-5 | +.5
ANALOG TUNING
C23 6.8
R6
L2

M9W / M9W-1
SWEEP OSCILLATOR
REV. 0



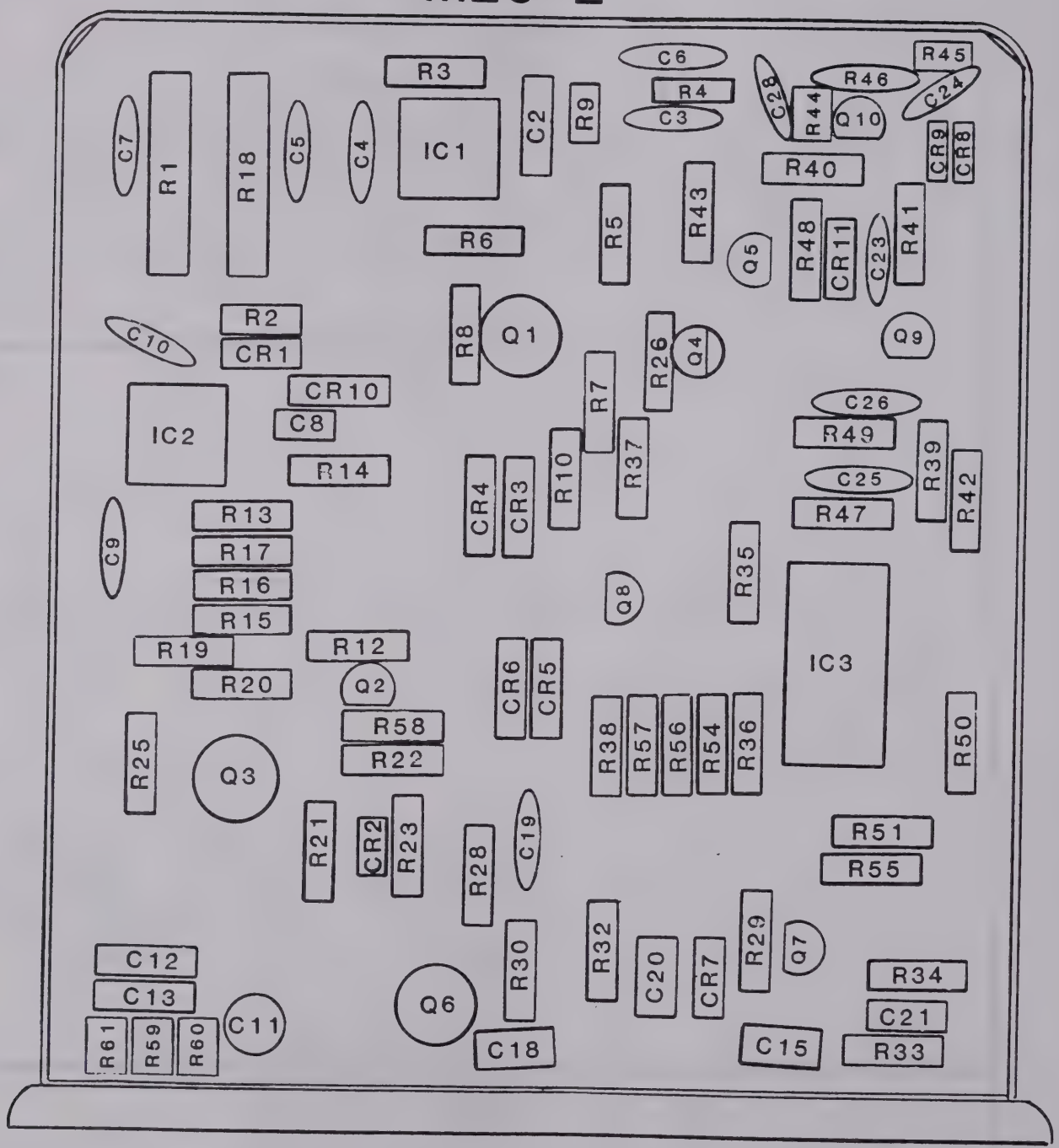
M10W-17
OUTPUT AMP Rev. A

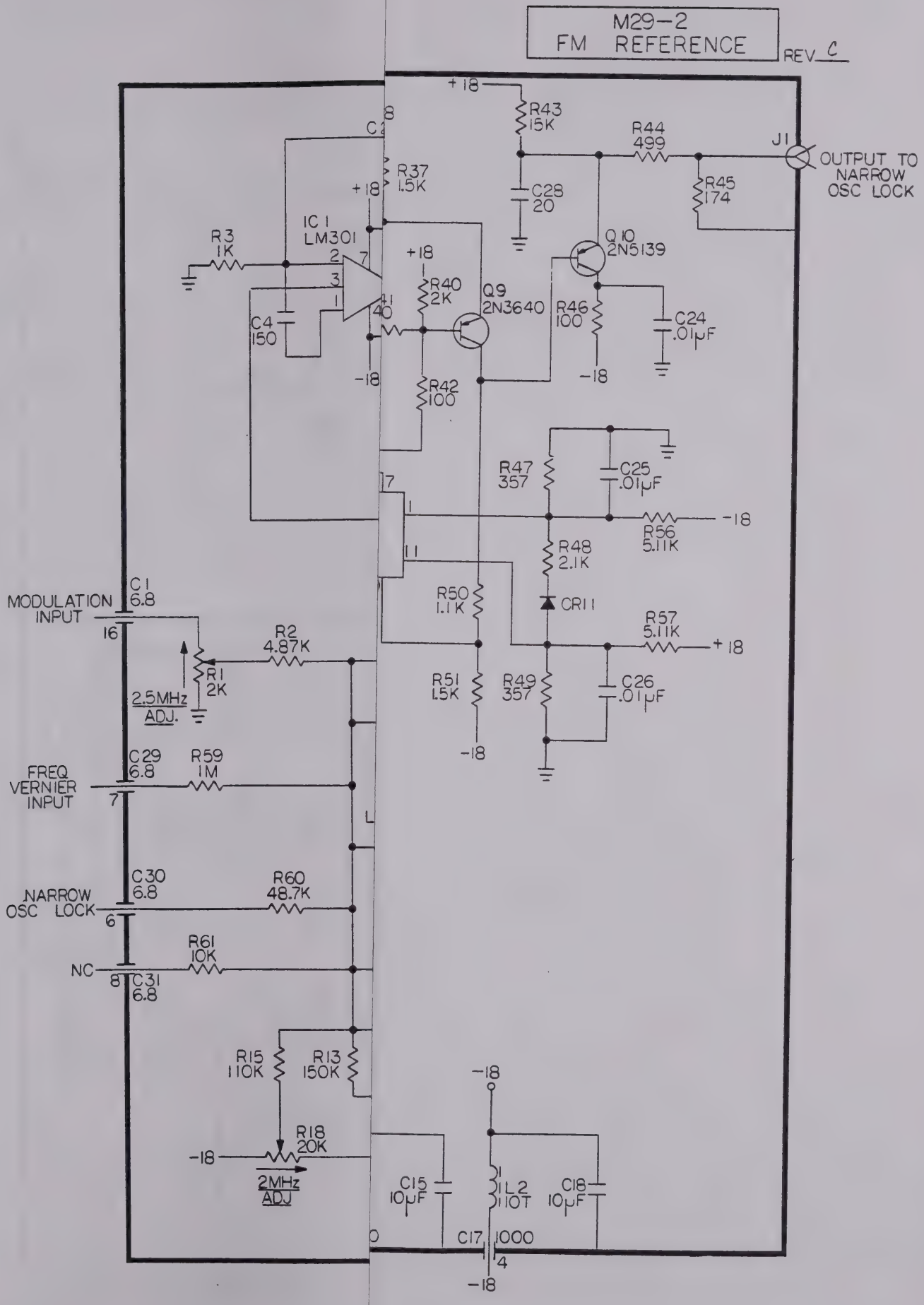


M10W-17
OUTPUT AMP REV. A

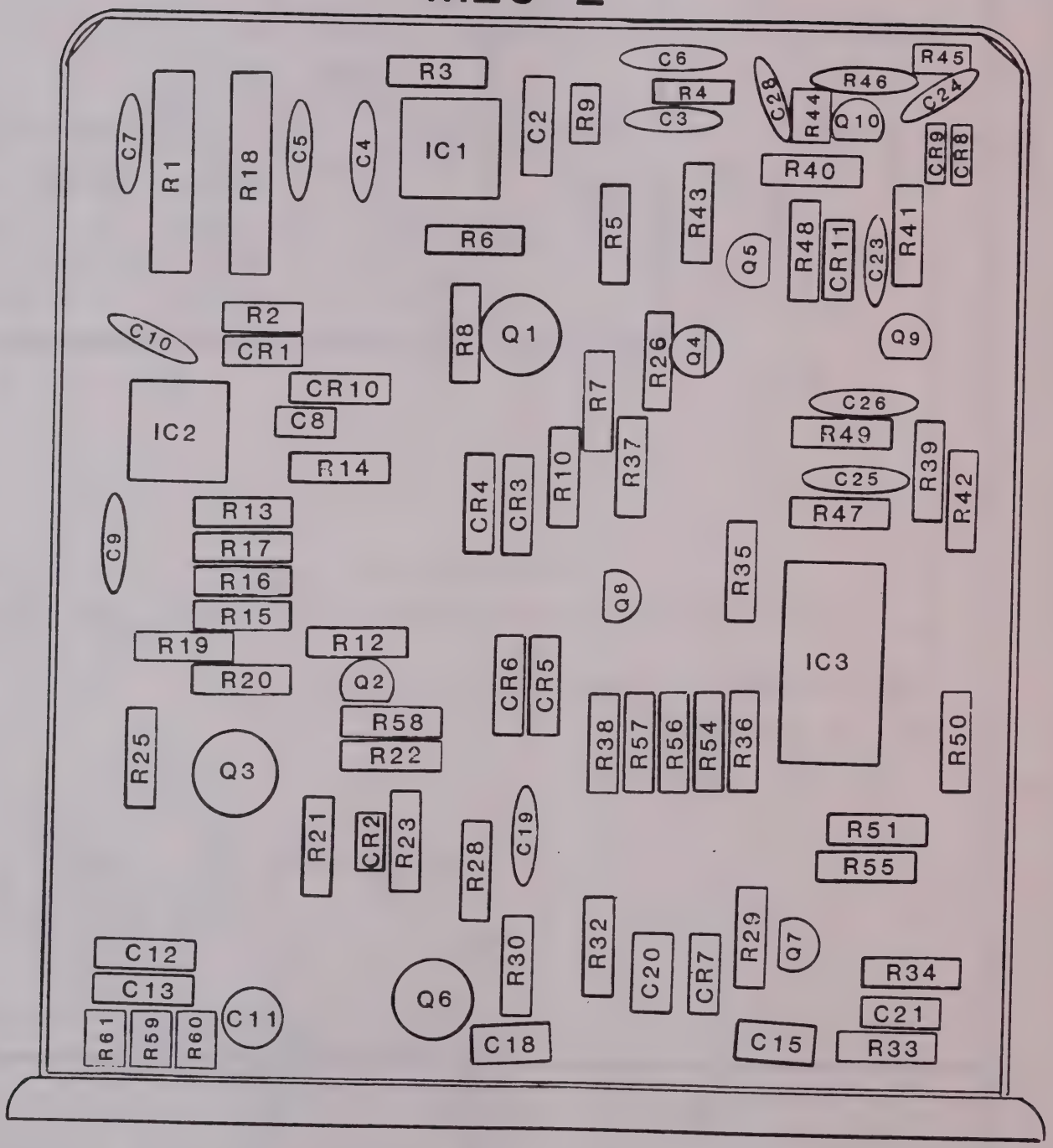
RF IN J1
L1 47
R1 120 *
CR2
CR3
L3 10T
C2 2.4
L22
R2 330
C1 200
L104 .22
R123 47
C113 .01µF
R101 1K
L101 33
C115 .1µF
C102 .1µF
R105 6.8K
R106 120
Q101 NE02135
C101 * 1.0
R102 120
R104 24
R103 24
R107 470
C103 .1µF
R7 56
B+
C104 * 1200
R108 1K
L102 33
C116 .1µF
C106 .1µF
R112 6.8K
Q102 NE02135
R109 120
* C105 1.0
R110 24
R111 24
R113 120
R114 470
C107 .1µF
R8 56
B+
C108 .01µF
C114 .01µF
C118 *
L103 33
C117 .1µF
C110 .1µF
R119 * 4.7K
Q103 NE41635
R115 1K
R116 120
* C109 1.0
R117 24
R118 24
R120 120
R121 390
R122 390
C111 .1µF
R9 56
B+
R14 47
C22 .1µF
R10 160
C3 .1µF
L10 47
CR5
C30 *
R16 * 120
C21 500
R17 2.7K
Q1 BFR94
L11 33
C20 .15µF
J1
CR4
L4 4T
R19 4.3K
C27 .01µF
C28 .05µF
R20 15K
C29 10µF
-18
J2
TO M43
LEVEL CIRCUIT
C204 100
IC201A NE5533AN
+18
R202 560K
R203 560K
R201 1K
C201 1000
R204 10K
CR201
R210 15K
R213 22K
C203 * 270
R206 18K
CR202
R207 22K
CR203
IC201B NE5533AN
CR204
R214 22K
R208 22K
C205 10µF
C207 1µF
C206 10µF
R211 20
R209 2.2K
C208 .05µF
R212 12K
Q201 2N3906
B+
C7 10µF
L6 10T
+18
-18
C8 100
C9 100
C25 100
C14 100
C15 100
L7 10T
L8 10T
L9 10T
R5 470
R6 1K
C11 1000
C12 1000
C24 1000
C16 1000
C17 6.8
C26 100
4
-18S
3
+18S
5
+18D
1
UNLEVELED
15
LEVELER INPUT
8
DOWN-CONVERTER ENABLE
K1
J3 FROM M115
J4 RF OUT
J5 TO M115
B+
R18 220
CR6
Q2 2N3904
CR7

M29-2


R3
C6
R4
C3
C28
R45
R46
C24
R44
Q10
CR9
CR8
C7
R1
R18
C5
C4
IC1
C2
R9
R40
R6
R5
R43
Q5
R48
CR11
C23
R41
R2
CR1
C10
R8
Q1
R26
Q4
Q9
CR10
C8
IC2
R7
C26
R49
R14
R10
R37
CR4
CR3
C25
R39
R42
R47
C9
R13
R17
R16
R15
R35
Q8
IC3
R19
R12
R20
Q2
CR6
CR5
R58
R22
R38
R57
R56
R54
R36
R50
R25
Q3
R21
CR2
R23
R28
C19
R51
R55
C12
C13
R61
R59
R60
C11
Q6
R30
R32
C20
CR7
R29
Q7
R34
C21
C18
C15
R33


M29-2
FM REFERENCE
REV C
+18
R43
15K
R44
499
J1
OUTPUT TO
NARROW
OSC LOCK
R45
174
C28
20
R37
1.5K
IC 1
LM301
R3
1K
Q 10
2N5139
R40
2K
Q9
2N3640
R46
100
C24
.01μF
C4
150
40
R42
100
-18
R47
357
C25
.01μF
R56
5.11K
R48
2.1K
CR11
R50
1.1K
R57
5.11K
MODULATION
INPUT
C1
6.8
R2
4.87K
R1
2K
2.5MHz
ADJ.
R51
1.5K
R49
357
C26
.01μF
C29
6.8
R59
1M
FREQ
VERNIER
INPUT
C30
6.8
R60
48.7K
NARROW
OSC LOCK
R61
10K
NC
C31
6.8
R15
110K
R13
150K
R18
20K
2MHz
ADJ
C15
10μF
L2
110T
C18
10μF
C17
1000

M29-2

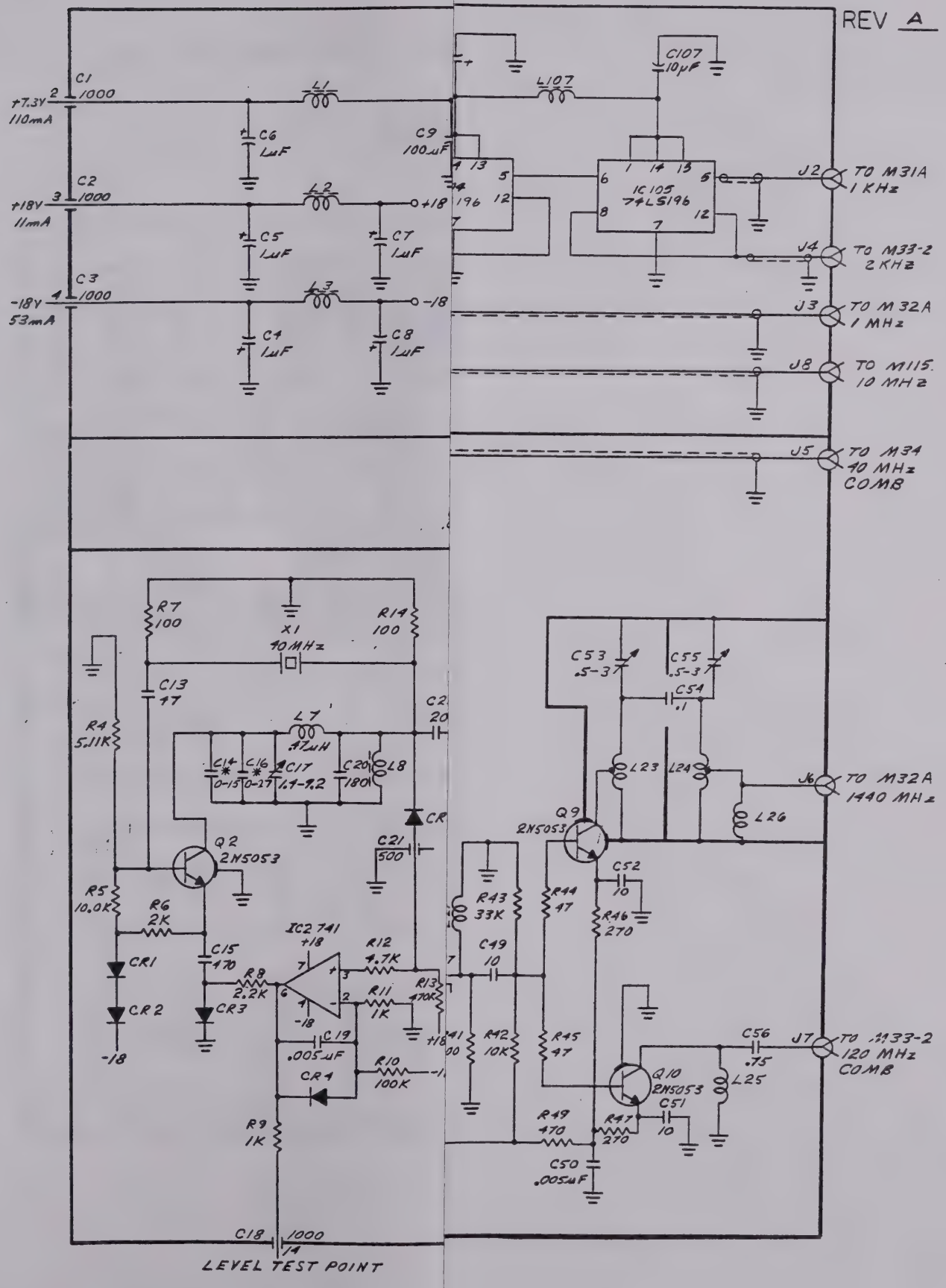

R3
C6
R4
C3
R45
R46
C24
C28
R44
Q10
CR9
CR8
R40
C7
R1
R18
C5
C4
IC1
C2
R9
R5
R43
Q5
R48
CR11
C23
R41
R6
R8
Q1
R26
Q4
Q9
R2
CR1
C10
CR10
C8
IC2
R14
R7
C26
R49
R10
R37
R39
R42
C25
R47
CR4
CR3
R13
R17
R16
R15
C9
R35
Q8
IC3
R19
R12
R20
Q2
CR6
CR5
R58
R22
R38
R57
R56
R54
R36
R50
R25
Q3
R21
CR2
R23
C19
R28
R51
R55
R32
C20
CR7
R29
Q7
R34
C12
C13
C11
Q6
R30
C21
R61
R59
R60
C18
C15
R33

M29-2
FM REFERENCE
REV C

MODULATION INPUT
C1 6.8
16
R2 4.87K
R1 2K
2.5MHz ADJ.
C2 75
C3 .01µF
IC1 LM301
R3 1K
C4 150
C5 .01µF
R4 2K
C6 .003µF
R5 1K
R7 2K
R8 249
R10 1K
Q1 TD401
R6 110
R9 499
C7 68
CR1
R12 110K
FREQ VERNIER INPUT
C29 6.8
7
R59 1M
C8 .01µF
IC2 LM301
C9 .01µF
NARROW OSC LOCK
C30 6.8
6
R60 48.7K
C10 150
NC
8
C31 6.8
R61 10K
R16 1K
R15 110K
R13 150K
R17 5.11K
CR10
R18 20K
2MHz ADJ
R19 1K
R14 499
R58 4.02K
Q2 MPS3702
R20 4.02K
R21 249
Q3 TD101
CR2
R22 1K
R23 4.02K
R25 1K
CR3
CR4
CR5
CR6
C11 7/35
C12 27
C13 470
Q6 AD395C
R30 499
Q7 2N5139
C27 .01µF
R32 499
C20 .001µF
CR7
R26 33.2
Q4 2N3904
Q5 2N3906
C23 20
R37 1.5K
R43 15K
C28 20
R44 499
J1
OUTPUT TO NARROW OSC LOCK
R45 174
Q10 2N5139
R46 100
C24 .01µF
Q8 2N3640
R38 2K
CR8
CR9
R41 100
R40 2K
Q9 2N3640
R39 100
R42 100
R28 100
C19 .01µF
R29 5.11K
R33 499
R34 845
C21 100
IC3 CA3102AE
R35 1.1K
R36 1.5K
R50 1.1K
R51 1.5K
R47 357
C25 .01µF
R56 5.11K
R48 2.1K
CR11
R57 5.11K
R49 357
C26 .01µF
R55 2.49K
R54 15K
L1 10T
C15 10µF
C16 1000
L2 10T
C18 10µF
C17 1000
+18
-18

M30-9
CRYSTAL REFERENCE

REV A

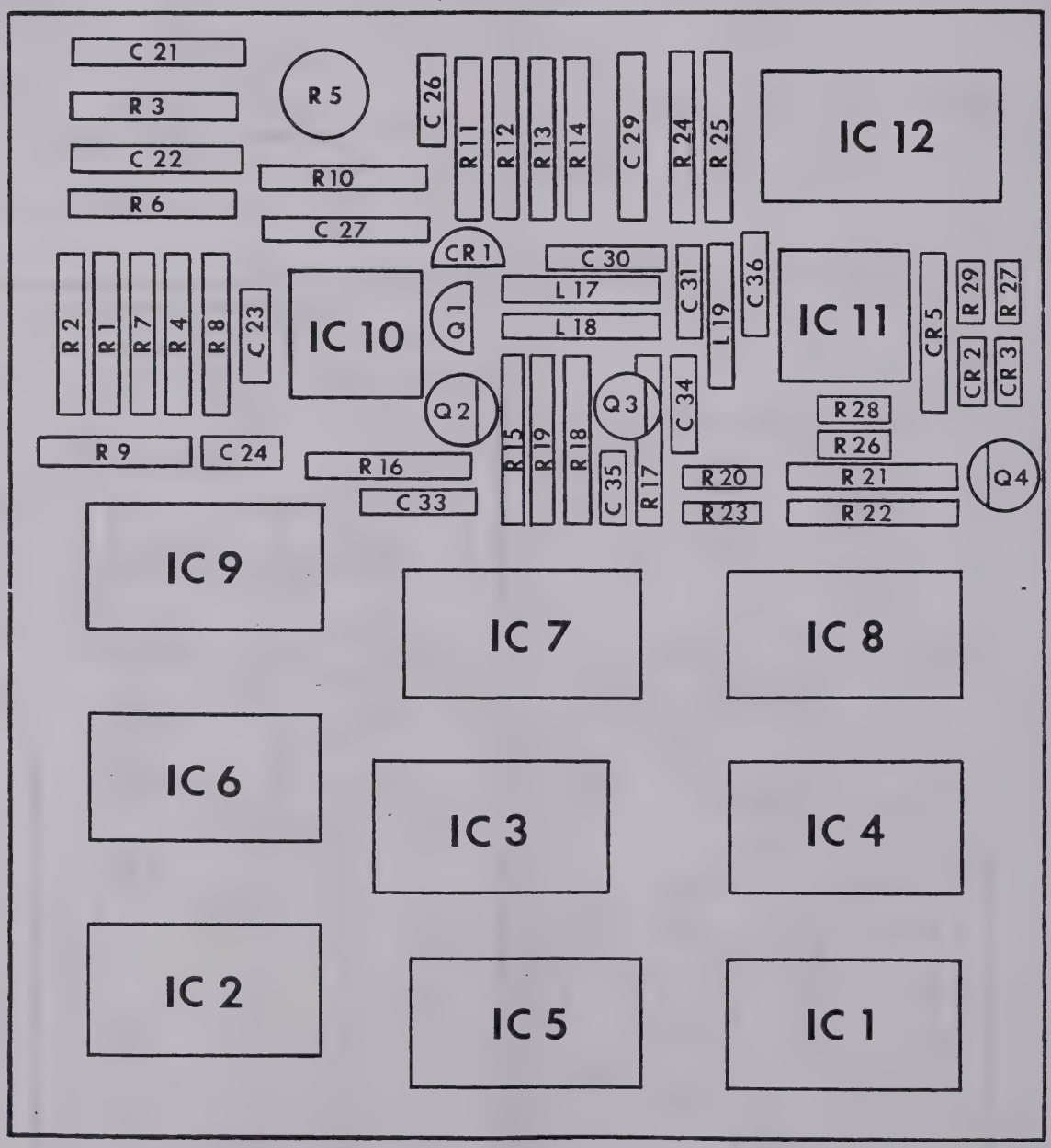


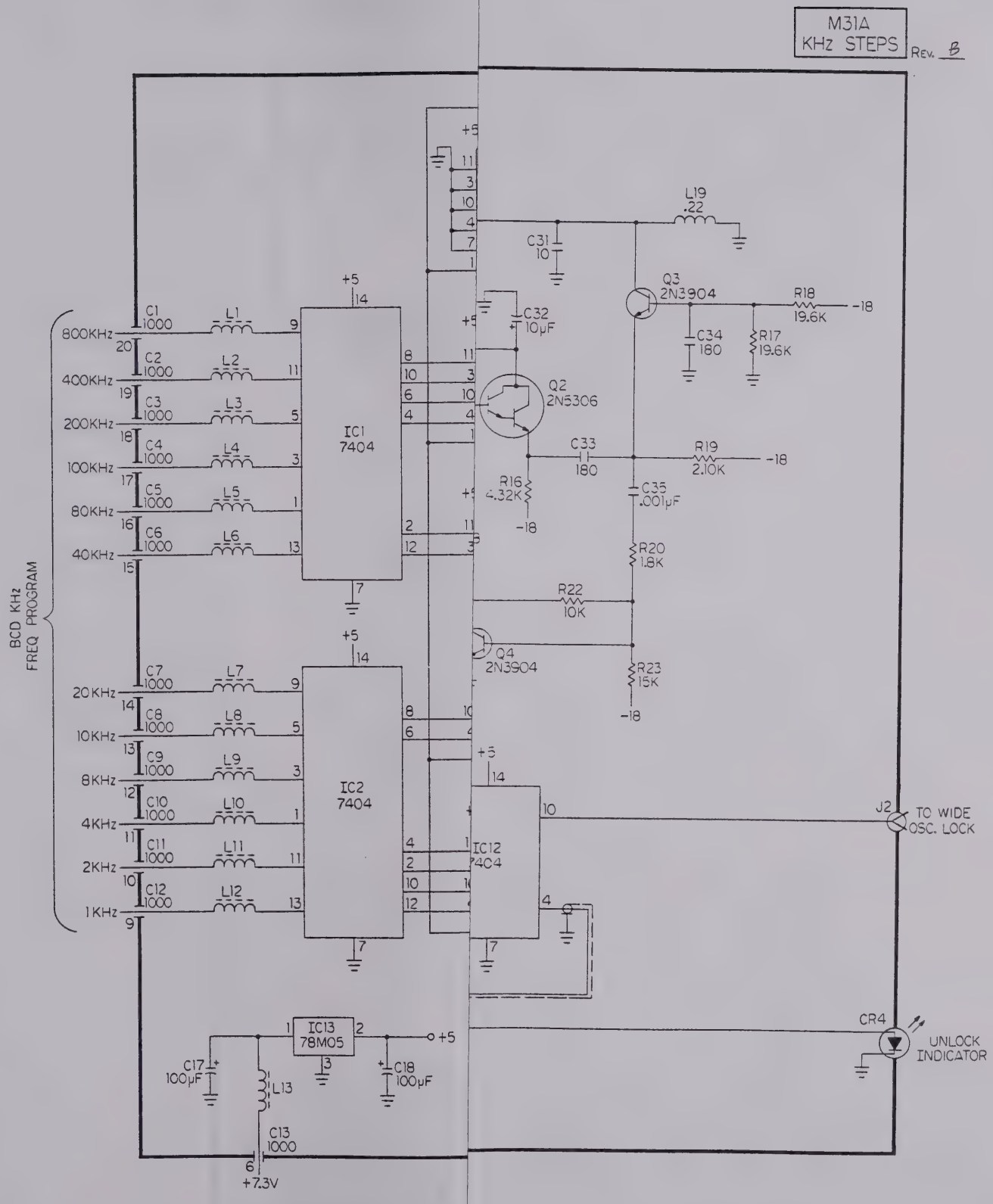
M30-9
CRYSTAL REFERENCE

REV A

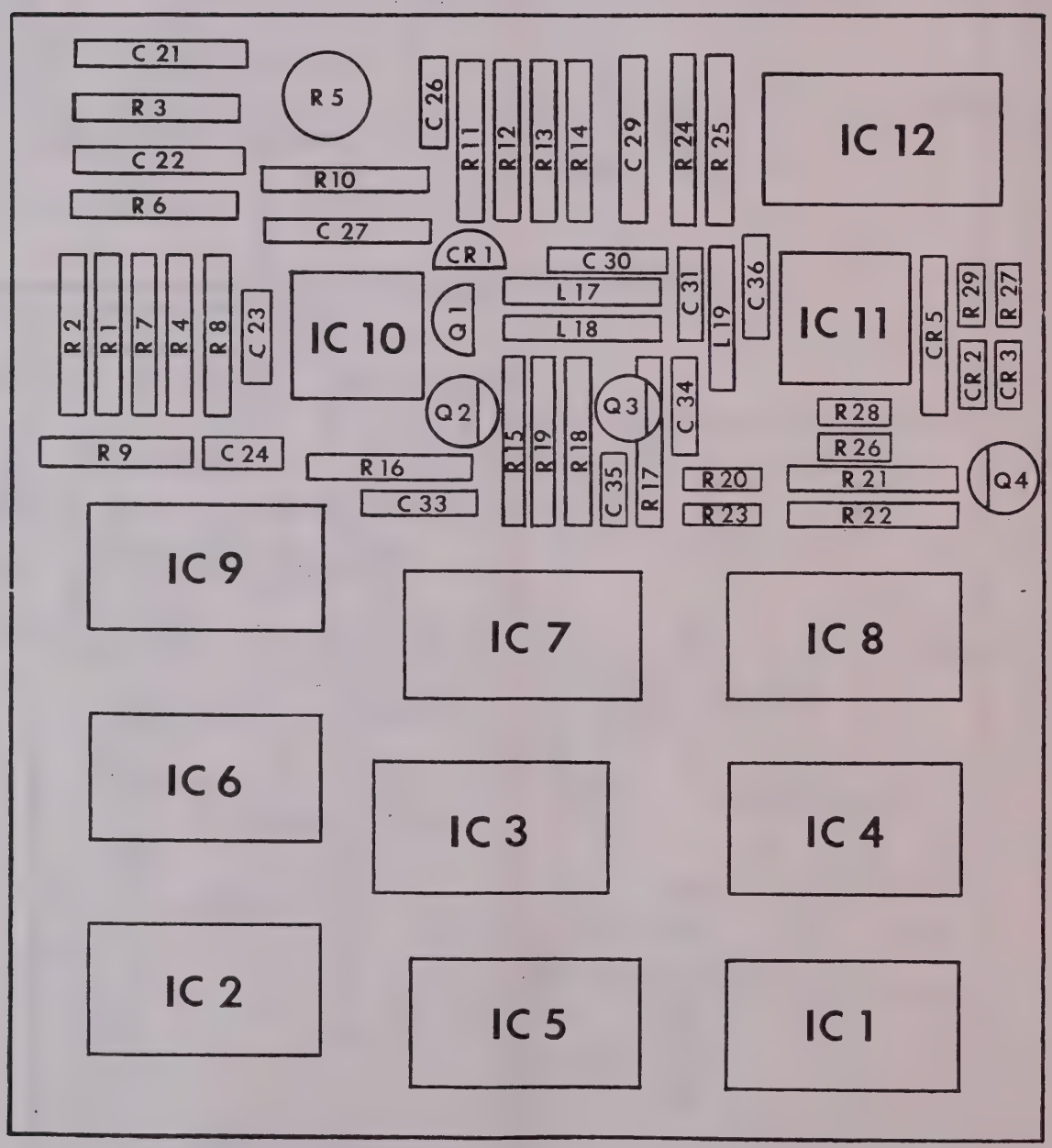
+7.3V 110mA
+18V 11mA
-18V 53mA
C1 1000
C2 1000
C3 1000
L1
L2
L3
C6 1µF
C9 100µF
C5 1µF
C7 1µF
C4 1µF
C8 1µF
IC1 78M05
+5
C10 100µF
C101 10µF
L101
C103 10µF
L103
L104
TO M44 2MHz
J1
R101 390
L102
R102 100
IC101 74S74
Q1 2N5053
R52 100
R103 1.8K
C102 .01µF
-18
C104 10µF
L105
R106 1K
C105 10µF
L106
C106 10µF
L107
C107 10µF
IC102 74176
IC103 74LS196
IC104 74LS196
IC105 74LS196
R104 2K
Q101 2N3904
R105 1K
J2 TO M31A 1 KHz
J4 TO M33-2 2 KHz
J3 TO M32A 1 MHz
J8 TO M115 10 MHz
J5 TO M34 10 MHz COMB
Q11 2N3904
CG0 .01
R51 10K
R50 4.7K
R22 1K
C29 .001
C28 2200
R15 40.2K
R18 2.00K
Q4 2N3904
C26 35-13
C27 4.7M
T1
R24 10
C30 15
R25 100
CR6
C31 2
R26 100
C32 4.7
C34 3.5-13
C36 3.5-13
C39 3.5-13
L10
L11
C33 1.1
L12 .22
C35 .47
L13 .22
C37 .47
L14 .22
C38 1.1
Q6 2N5053
R28 22K
R27 47K
R29 2.2K
R30 33K
Q7 2N5053
C43 27
L15 .22
C57 3.5-13
L19 .22
L20 1
R34 22
C42 3.5-13
R36 33K
R37 22
C41 3.5-13
R48 10
C44 10
L18 .1
Q8 2N5053
R38 47
C46 500
R35 10K
R39 470
R31 10K
C40 2200
R32 47
C41 500
R33 470
L17
C45 2200
L16
+18
C48 100
CR7
R40 82
C49 10
R41 100
R42 10K
R43 33K
L21
R44 47
R45 47
C52 10
R46 270
C53 .5-3
C55 .5-3
C54 .1
L23
L24
L26
J6 TO M32A 1440 MHz
Q9 2N5053
Q10 2N5053
C56 .75
L25
J7 TO M33-2 120 MHz COMB
C51 10
R49 470
R47 270
C50 .005µF
R7 100
X1 40 MHz
R14 100
C13 47
R4 5.11K
L7 .47µH
C14 0-15
C16 0-27
C17 1.1-9.2
C20 180
L8
C22 20
CR5
Q2 2N5053
C21 500
R5 10.0K
R6 2K
CR1
CR2
-18
C15 470
R8 2.2K
CR3
IC2 741
+18
R12 4.7K
R13 470K
R11 1K
C19 .005µF
CR4
R10 100K
R9 1K
C18 1000
1A
LEVEL TEST POINT
Q3 2N5179
R16 15.0K
C23 100
R17 1.5K
R19 2.00K
Q5 2N3904
R21 220
C24 2200
R20 1.8K
C25 2200
L9
```
```

M31A


C 21
R 3
C 22
R 6
R 5
R 10
C 27
C 26
R 11
R 12
R 13
R 14
C 29
R 24
R 25
IC 12
CR 1
C 30
L 17
L 18
C 31
L 19
C 36
IC 11
CR 5
R 29
R 27
CR 2
CR 3
R 2
R 1
R 7
R 4
R 8
C 23
IC 10
Q 1
Q 2
Q 3
C 34
R 28
R 26
R 21
R 22
Q 4
R 15
R 19
R 18
C 35
R 17
R 20
R 23
R 9
C 24
R 16
C 33
IC 9
IC 7
IC 8
IC 6
IC 3
IC 4
IC 2
IC 5
IC 1


M31A
KHz STEPS
Rev. B
BCD KHz
FREQ PROGRAM
800KHz
400KHz
200KHz
100KHz
80KHz
40KHz
20KHz
10KHz
8KHz
4KHz
2KHz
1KHz
C1 1000
C2 1000
C3 1000
C4 1000
C5 1000
C6 1000
C7 1000
C8 1000
C9 1000
C10 1000
C11 1000
C12 1000
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
L12
IC1 7404
IC2 7404
IC12 7404
+5
L19 .22
C31 10
Q3 2N3904
R18 19.6K
-18
C34 180
R17 19.6K
C32 10µF
Q2 2N5306
C33 180
R19 2.10K
R16 4.32K
C35 .001µF
R20 1.8K
R22 10K
Q4 2N3904
R23 15K
J2
TO WIDE OSC. LOCK
CR4
UNLOCK INDICATOR
IC13 78M05
C17 100µF
C18 100µF
L13
C13 1000
+7.3V

M31A


C 21
R 3
C 22
R 6
R 5
R10
C 27
C 26
R 11
R 12
R 13
R 14
C 29
R 24
R 25
IC 12
CR 1
C 30
L 17
L 18
C 31
L 19
C 36
IC 11
CR 5
R 29
R 27
CR 2
CR 3
R 2
R 1
R 7
R 4
R 8
C 23
IC 10
Q 1
Q 2
Q 3
C 34
R 28
R 26
R 21
R 22
Q 4
R 9
C 24
R 16
C 33
R 15
R 19
R 18
C 35
R 17
R 20
R 23
IC 9
IC 7
IC 8
IC 6
IC 3
IC 4
IC 2
IC 5
IC 1

M31A
KHz STEPS
REV. B

1KHz REF
J1

BCD KHz
FREQ PROGRAM

800KHz
400KHz
200KHz
100KHz
80KHz
40KHz
20KHz
10KHz
8KHz
4KHz
2KHz
1KHz

C1 1000 L1
C2 1000 L2
C3 1000 L3
C4 1000 L4
C5 1000 L5
C6 1000 L6
C7 1000 L7
C8 1000 L8
C9 1000 L9
C10 1000 L10
C11 1000 L11
C12 1000 L12

IC1 7404
IC2 7404
IC3 74LS196
IC4 74LS196
IC5 74LS196
IC6 74LS196
IC7 74H102
IC8 74H11
IC9 11C44
IC10A 4558
IC10B 4558
IC11 741
IC12 7404
IC13 78M05

R1 4.7K
R2 4.7K
R3 30K
R4 30K
R5 2K
R6 30K
R7 30K
R8 47K
R9 68K
R10 6.8K
R11 6.8K
R12 3.3K
R13 10K
R14 6.8K
R15 30.1K
R16 4.32K
R17 19.6K
R18 19.6K
R19 2.10K
R20 1.8K
R21 1K
R22 10K
R23 15K
R24 2.7K
R25 10K
R26 30K
R27 47K
R28 160K
R29 20K
R30 1.8K

C21 .12μF
C22 .12μF
C23 1μF
C24 1μF
C25 10μF
C26 1μF
C27 .12μF
C28 10μF
C29 .12μF
C30 1000
C31 10
C32 10μF
C33 180
C34 180
C35 .001μF
C36 .01μF
C37 10μF
C13 1000
C14 1000
C15 1000
C16 1000
C17 100μF
C18 100μF
C19 10μF
C20 10μF

L13
L14
L15
L16
L17 2.2
L18 .47
L19 .22

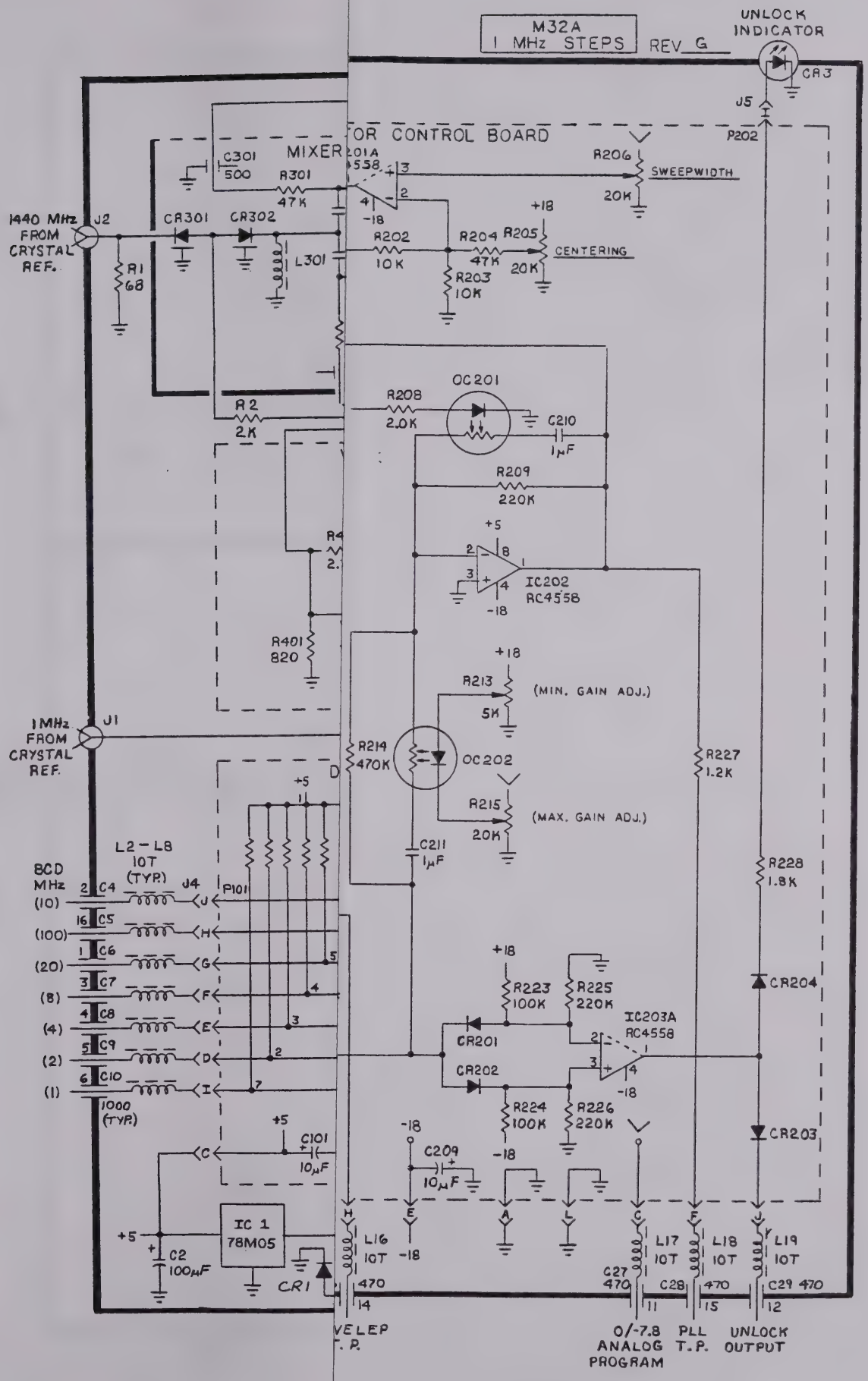
CR1
CR2
CR3
CR4 UNLOCK INDICATOR
CR5

Q1 2N5458
Q2 2N3306
Q3 2N3904
Q4 2N3904

+5
+18
-18
-18
+7.3V
+18V
-18V

J2 TO WIDE OSC. LOCK

UNLOCK OUTPUT


M32A
1 MHz STEPS
REV G
UNLOCK INDICATOR
CR3
J5
FOR CONTROL BOARD
P202
MIXER
C301
500
R301
47K
1440 MHz FROM CRYSTAL REF.
J2
CR301
CR302
L301
R1
68
R2
2K
R202
10K
R203
10K
R204
47K
R205
20K
CENTERING
+18
-18
R206
20K
SWEEPWIDTH
OC201
R208
2.0K
C210
1μF
R209
220K
IC202
RC4558
R401
820
1 MHz FROM CRYSTAL REF.
J1
R213
5K
(MIN. GAIN ADJ.)
R214
470K
OC202
R215
20K
(MAX. GAIN ADJ.)
C211
1μF
R227
1.2K
R228
1.8K
L2 – L8
10T
(TYP.)
BCD MHz
(10)
(100)
(20)
(8)
(4)
(2)
(1)
C4
C5
C6
C7
C8
C9
C10
1000 (TYP.)
J4
P101
R223
100K
R225
220K
IC203A
RC4558
CR201
CR202
R224
100K
R226
220K
CR204
CR203
C101
10μF
C209
10μF
IC 1
78M05
C2
100μF
CR1
L16
10T
L17
10T
L18
10T
L19
10T
C27
470
C28
470
C29
470
VELEP T. P.
0/-7.8 ANALOG PROGRAM
PLL T.P.
UNLOCK OUTPUT

M32A
1 MHz STEPS
REV G

1448 - 1487 OUTPUT TO WIDE OSC. LOCK
0dBm
J3

UNLOCK INDICATOR
CR3
J5
P202

1440 MHz FROM CRYSTAL REF.
J2
R1 68
CR301
CR302

MIXER
C301 500
R301 47K
CR303
C302 .001μF
C303 .001μF
L301
CR304
T301
C304
R302 47K
R303 390
C306 .001μF
C305 500
-18
R2 2K
UHF T.P.
J301
L302
C13 3.9

R3 430
R4 4.7K
Q1 2N5053
L11
R5 1K
C16 500
L13 10T
C17 500
R10 1K
C18 3.9
L20
R11 4.7K
R12 470
Q3 BFR90
C20 1.1
L14
C14 .62μF
C15 *
L12 *
R7 2.7
C21 .3/1.2
R6 10K
R8 4.7K
Q2 A430
L15 .22
R9 499
C19 500
-18
C22
CR1 100
R13 820
C23 100
CR2
C24 1μF

OSCILLATOR CONTROL BOARD
IC201A RC4558
R206 SWEEPWIDTH 20K
+18
R202 10K
R204 47K
R205 20K CENTERING
R203 10K
R201 6.8K
J5 P202 B
G
K
R207 15K

OC201
+5
R208 2.0K
C210 1μF
R209 220K
+5
IC202 RC4558
-18
+18
R213 5K (MIN. GAIN ADJ.)
R219 470K
OC202
R215 20K (MAX. GAIN ADJ.)
C211 1μF
R227 1.2K
R228 1.8K
CR204
CR203

VIDEO AMPLIFIER
+18
R404 3.3K
R408 820
R403 2.7K
R405 1K
C402 .005μF
C401 120
R406 2.7K
L401 .10μH
Q401 2N5053
Q402 2N5053
R401 820
R402 10
R407 820
R409 10
C403 39
J4
P101 A

L103 10T
L104 10T
+5
R108 499
C104 .1μF
R109 100K
J101
R107 1K
Q101 2N5053
CR104
C105 .001μF
C103 360
R106 15K
R105 2.1K
L102 10T
C102 .1μF
C
-18

P201
R210 15K
C201 .005μF
+18
IC2038 RC4558
R212 1K
C202 .001μF
R211 10K

1MHz FROM CRYSTAL REF.
J1

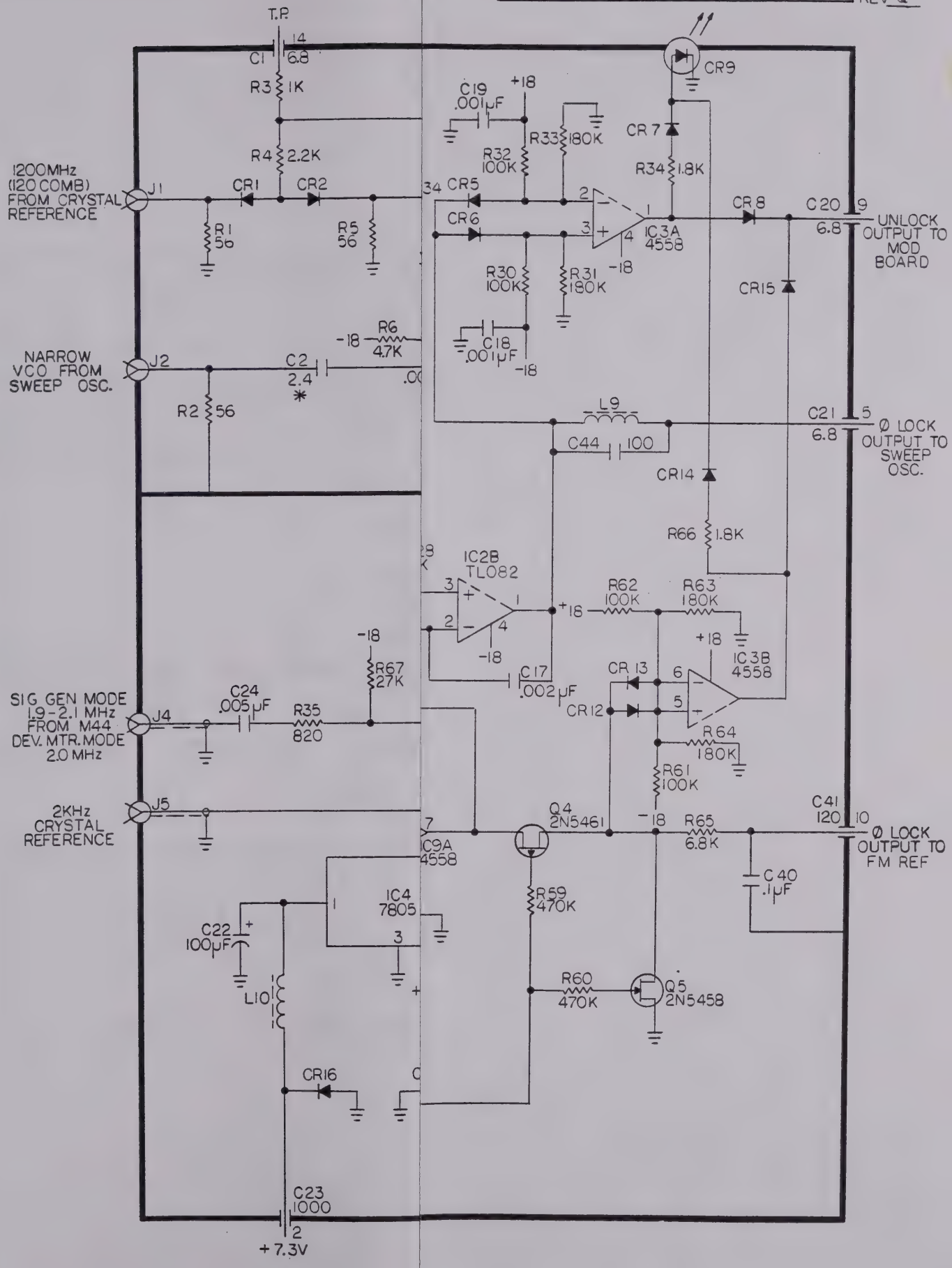
DIGITAL DIVIDER BOARD
+5
BCD MHz
(10) J
(100) H
(20) G
(8) F
(4) E
(2) D
(1) I
C
L2 - L8 10T (TYP.)
J4
P101
R101A-G 4.7K (TYP.)
1000 (TYP.)
IC101 74S288
IC102 74S196
IC103 74S196
IC104 74S112
IC105 11C44
CR101
R102 4.7K
+5V
CR102
CR103
C101 10μF
J102
L101 10T
C203 1μF
R103 33
R104 1.2K
R110 4.7K
R111 4.7K
VIDEO T.P.
P101 B
J4

R219 30K
R222 6.8K
C207 .047μF
R216 30K
R218 (BALANCE) 2K
R221 6.8K
IC2018 RC4558
C204 150
C205 150
R217 30K
C206 .047μF
R220 30K
+18
C208 10μF
P202 D
J5
+18
-18
C209 10μF
-18
CR201
CR202
R223 100K
R225 220K
IC203A RC4558
R224 100K
R226 220K
-18

+5
C2 100μF
IC 1 78M05
L1 10T
C3 1000
CR1
C1 10μF
+7.3
+18
C30 .1μF
L9 10T
CR2
C11 1000
+18
-18
C31 .1μF
L10 10T
CR3
C12 1000
-18
H
L16 10T
C26 470
14
LEVELEP T.P.
E
-18
A
C
L17 10T
C27 470
11
F
L18 10T
C28 470
15
L19 10T
C29 470
12
0/-7.8 ANALOG PROGRAM
PLL UNLOCK T.P. OUTPUT

M33-2
NARROW OSCILLATOR LOCK

REV Q



M33-2
NARROW OSCILLATOR LOCK

REV Q

1200MHz (120 COMB) FROM CRYSTAL REFERENCE

NARROW VCO FROM SWEEP OSC.

SIG GEN MODE 1.9-2.1 MHz FROM M44 DEV. MTR. MODE 2.0 MHz

2KHz CRYSTAL REFERENCE

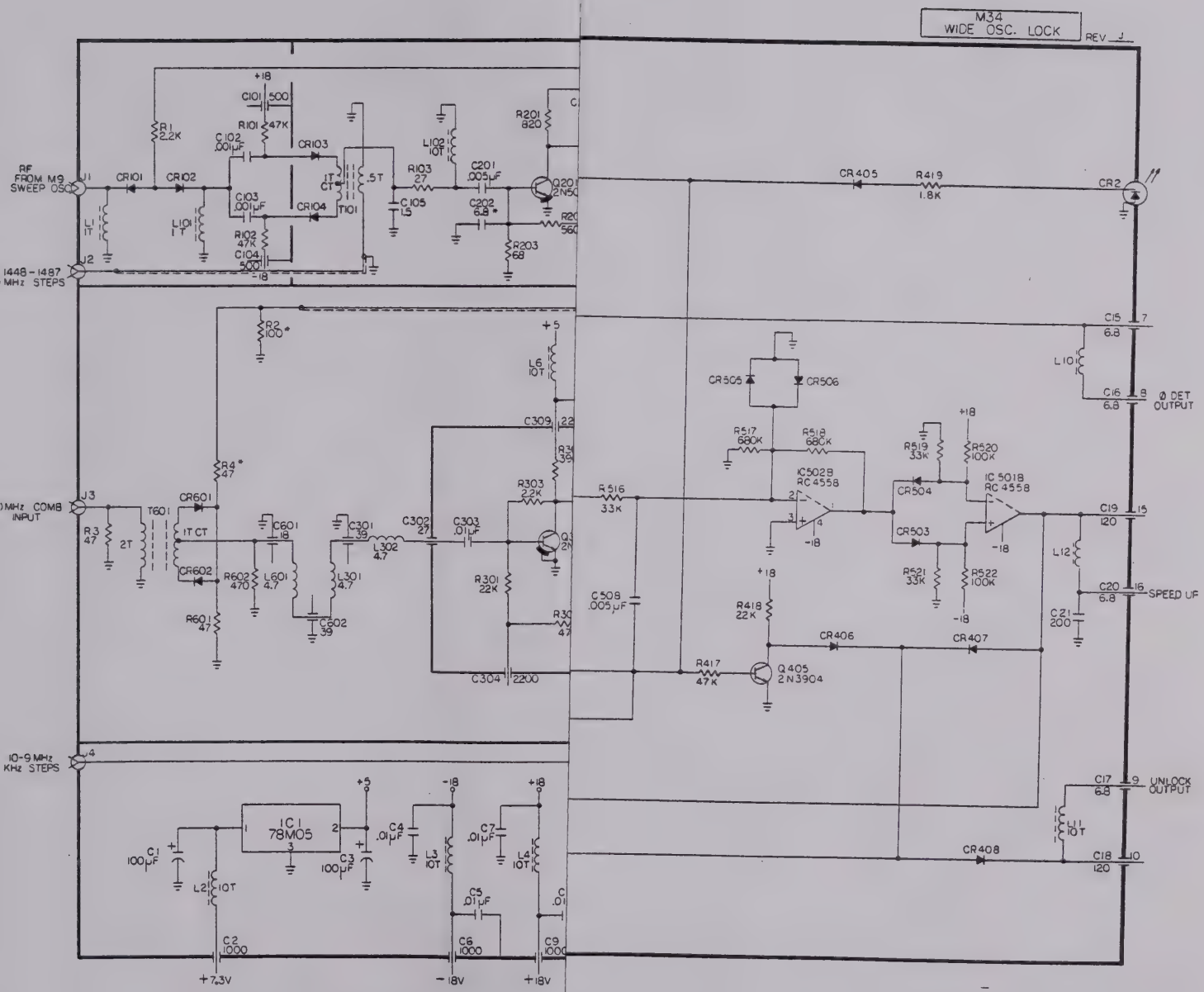
VIDEO T.P.

UNLOCK OUTPUT TO MOD BOARD

Ø LOCK OUTPUT TO SWEEP OSC.

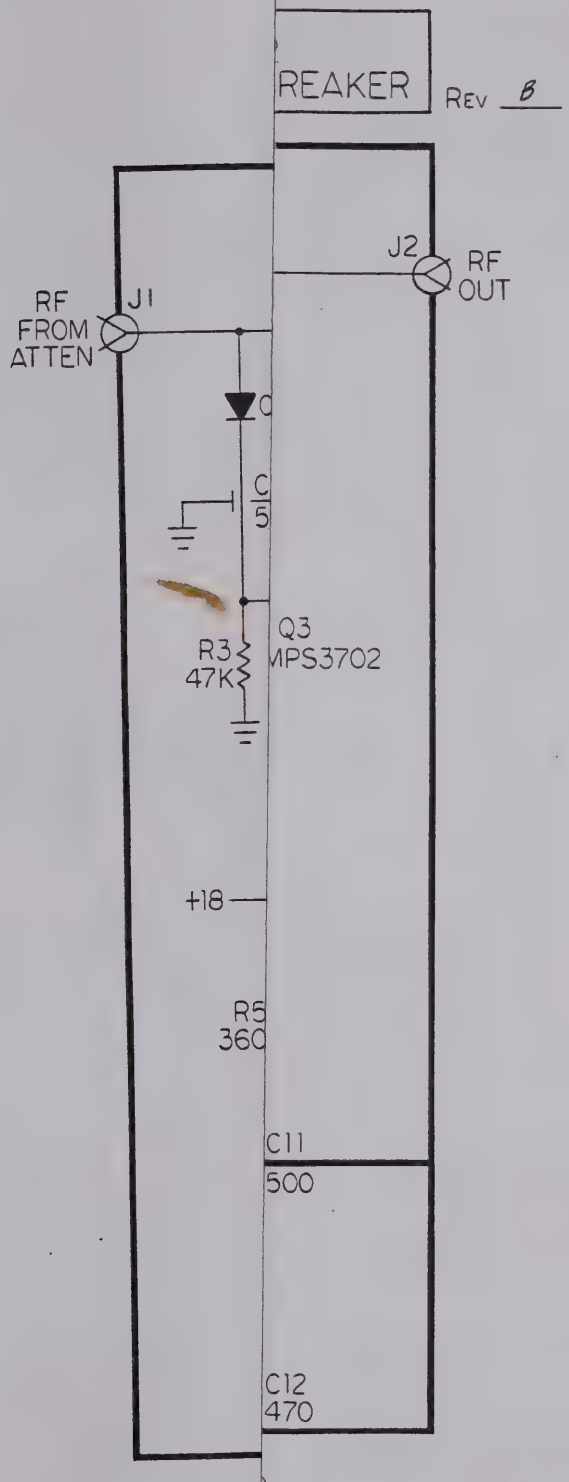
Ø LOCK OUTPUT TO FM REF

TO MOD BD PIN 4 +7.3V IN CAL


M34
WIDE OSC. LOCK
REV J
RF FROM M9 SWEEP OSC
J1
J2
1448-1487 MHz STEPS
J3
MHz COMB INPUT
J4
10-9 MHz KHz STEPS
CR101
CR102
CR103
CR104
CR405
CR2
R419 1.8K
R1 2.2K
R101 47K
R102 47K
R103 27
R201 820
R203 68
C101 500
C102 .001µF
C103 .001µF
C104 500
C105
C201 .005µF
C202 6.8
T101
L101 1T
L102 10T
Q201 2N5
+18
-18
R2 100
+5
L6 10T
C309
R4 47
R303 2.2K
R3 47
T601
2T
1T CT
CR601
CR602
C601
C602 39
C301 39
L301 4.7
L601 4.7
R602 470
R601 47
C302 27
C303 .01µF
L302 4.7
R301 22K
C304 2200
R516 33K
C508 .005µF
R417 47K
Q405 2N3904
CR505
CR506
R517 680K
R518 680K
IC5028 RC4558
IC 5018 RC 4558
R519 33K
R520 100K
R521 33K
R522 100K
CR504
CR503
R418 22K
CR406
CR407
C15 6.8
C16 6.8
Ø DET OUTPUT
C19 120
C20 6.8
SPEED UF
C21 200
L10
L12
C17 6.8
UNLOCK OUTPUT
L11 10T
CR408
C18 120
IC1 78M05
C1 100µF
C2 .1000
C3 100µF
C4 .01µF
C5 .01µF
C6 .1000
C7 .01µF
C9 .1000
L2 10T
L3 10T
L4 10T
+7.3V
-18V
+18V

M34
WIDE OSC. LOCK
REV J

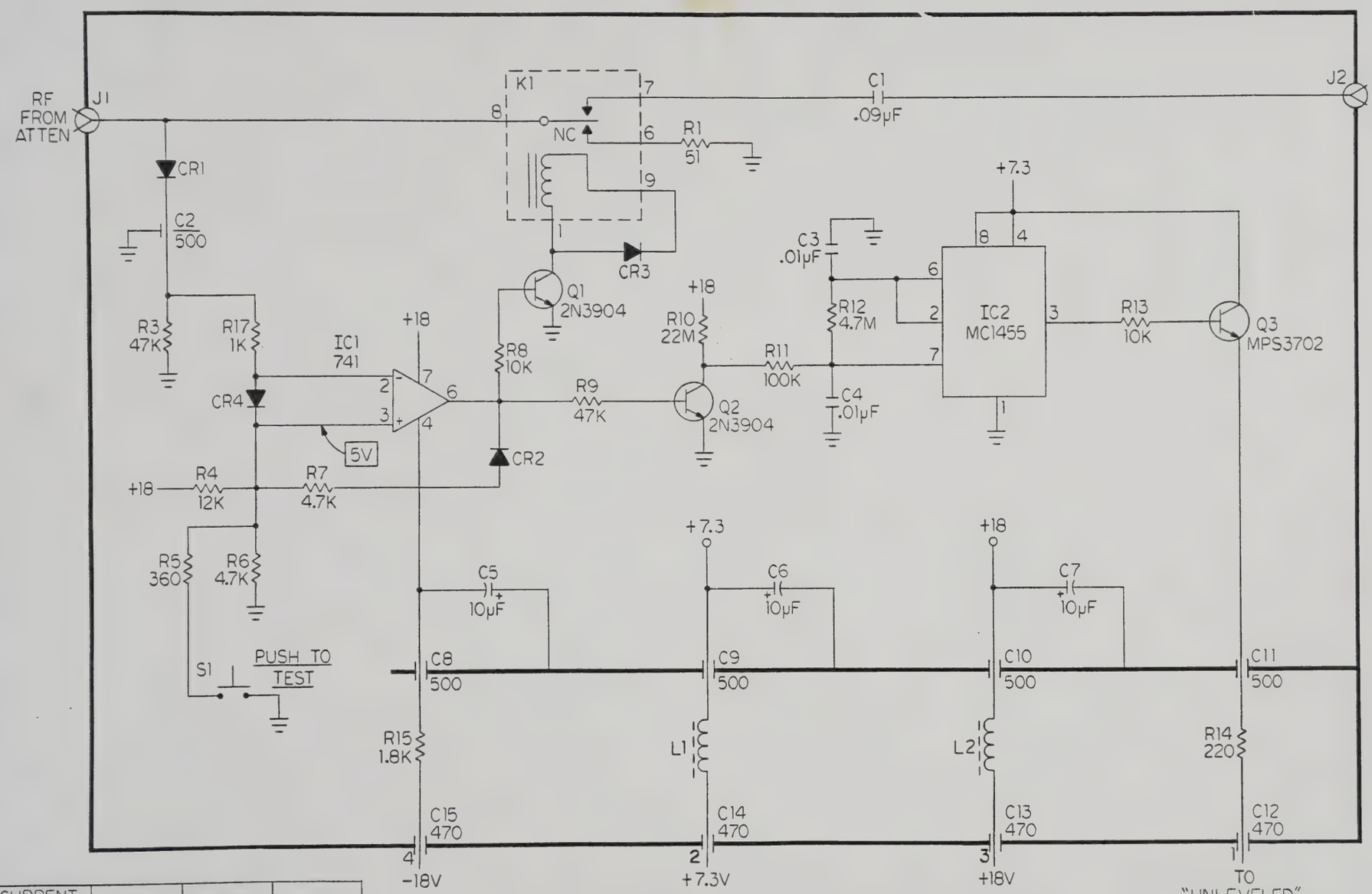
RF FROM M9 SWEEP OSC
1448 - 1487 MHz STEPS
70 MHz COMB INPUT
10-9 MHz KHz STEPS
VIDEO TP
LEVELER TP
Ø DET OUTPUT
SPEED UP
UNLOCK OUTPUT
+7.3V
-18V
+18V



CURRENT INPUTS	-18V
NORMAL OPERATION	1ma
TRIPPED	3ma

M35-1/2
RF CIRCUIT BREAKER

Rev B



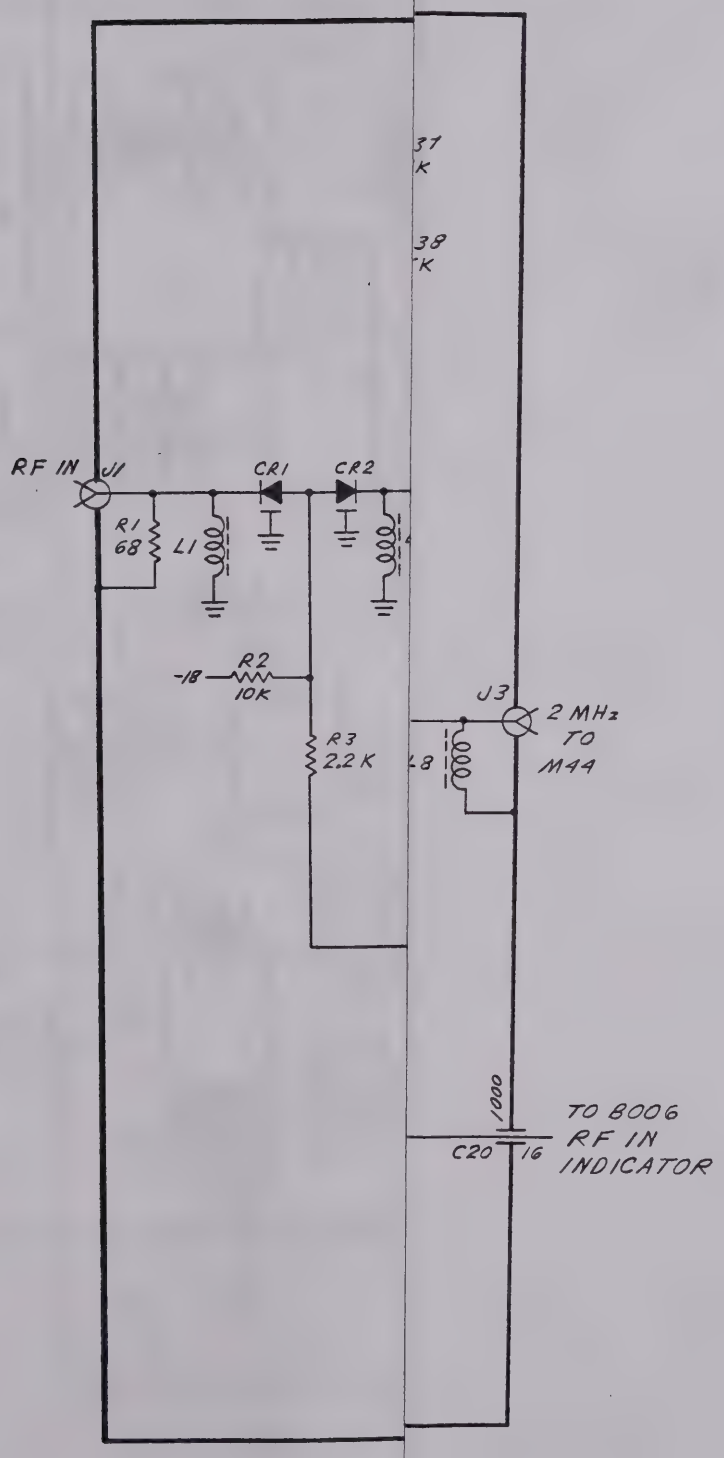
CURRENT INPUTS	-18V	+7.3V	+18V
NORMAL OPERATION	1ma	4ma	12ma
TRIPPED	3ma	8ma (AV)	3ma

NOTE : IN M35-2 C1 IS OMITTED.

M43

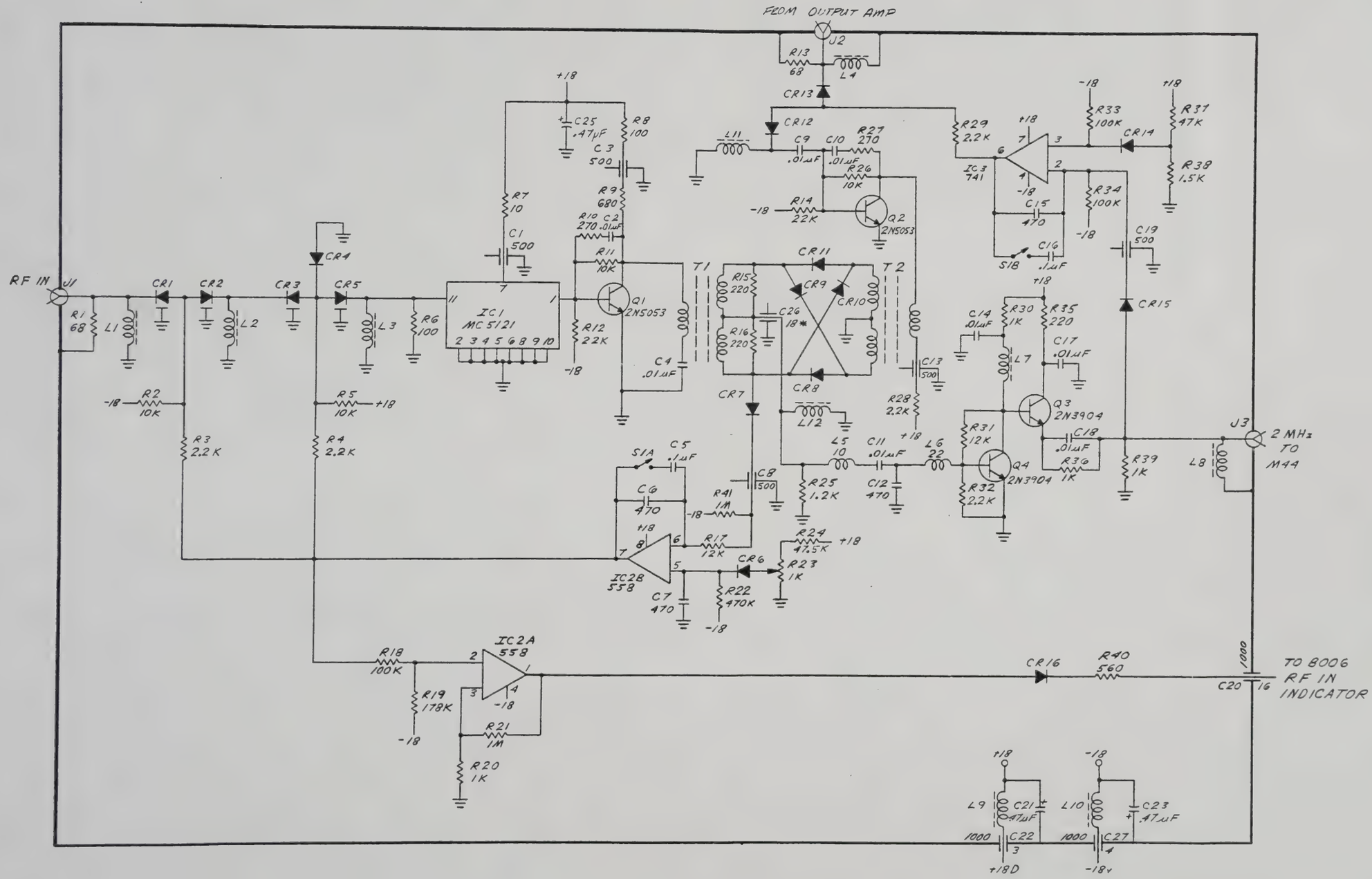
RF AMPLIFIER AND MIXER

REV D

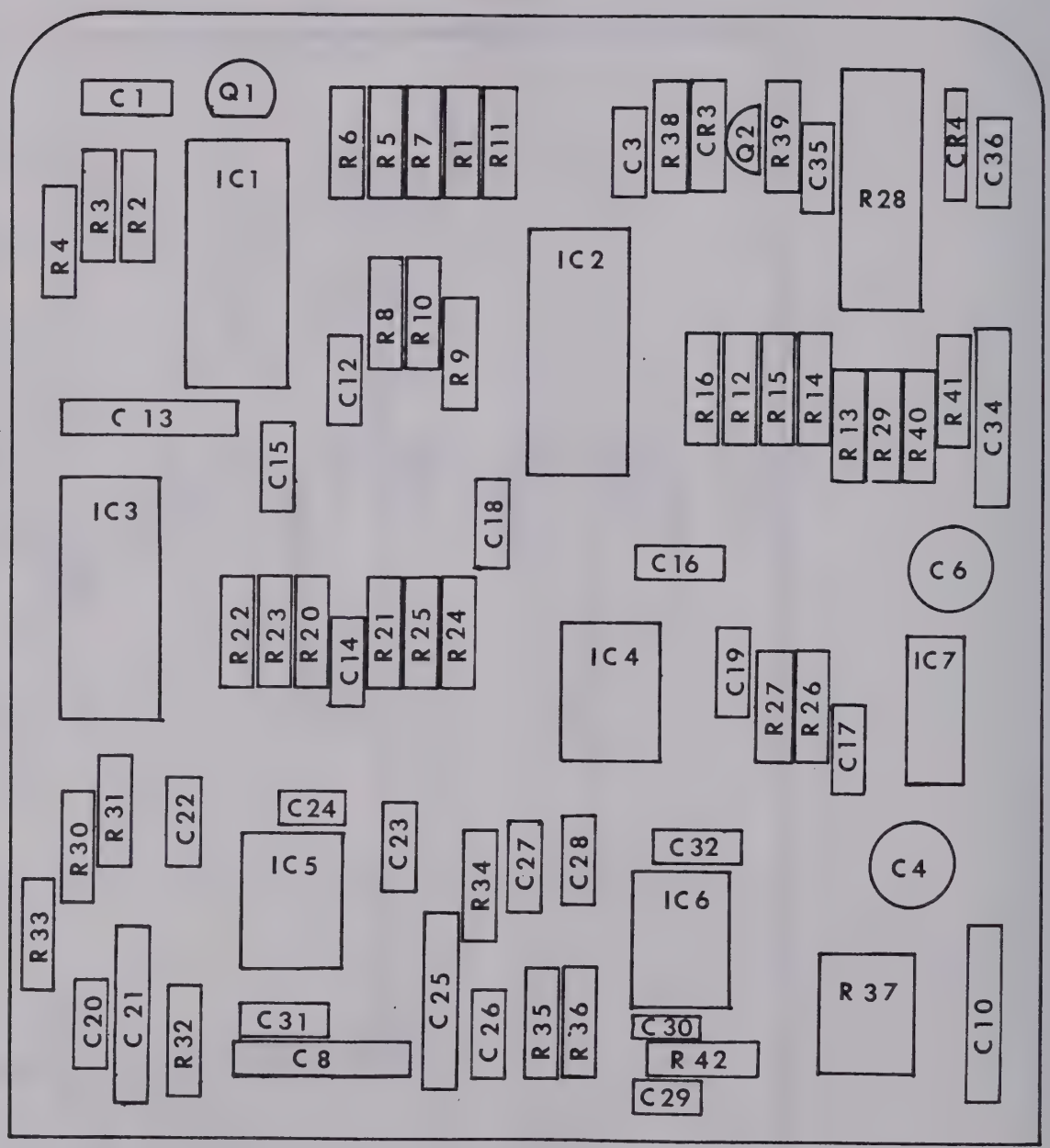


M43
RF AMPLIFIER AND MIXER

REV D

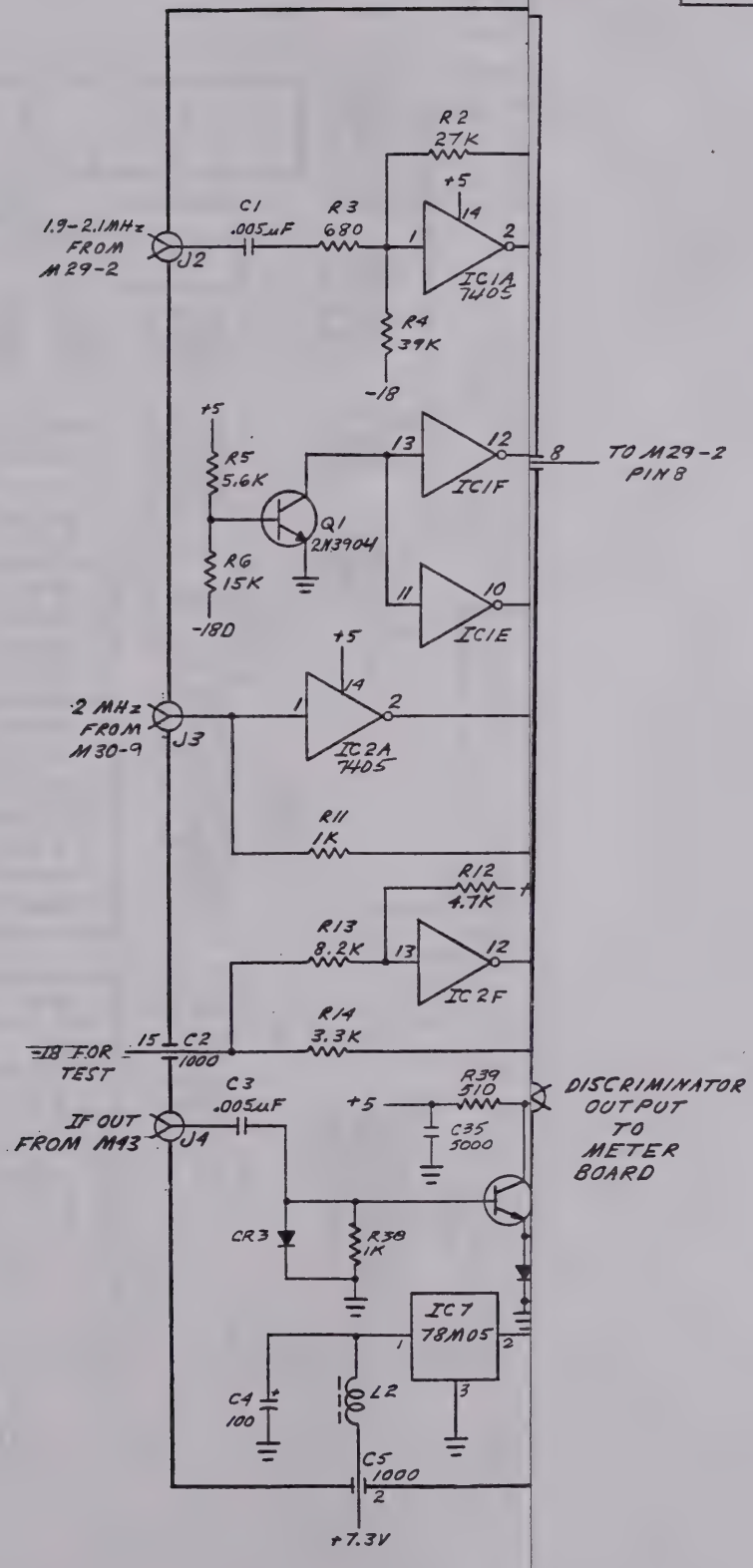


M44-1

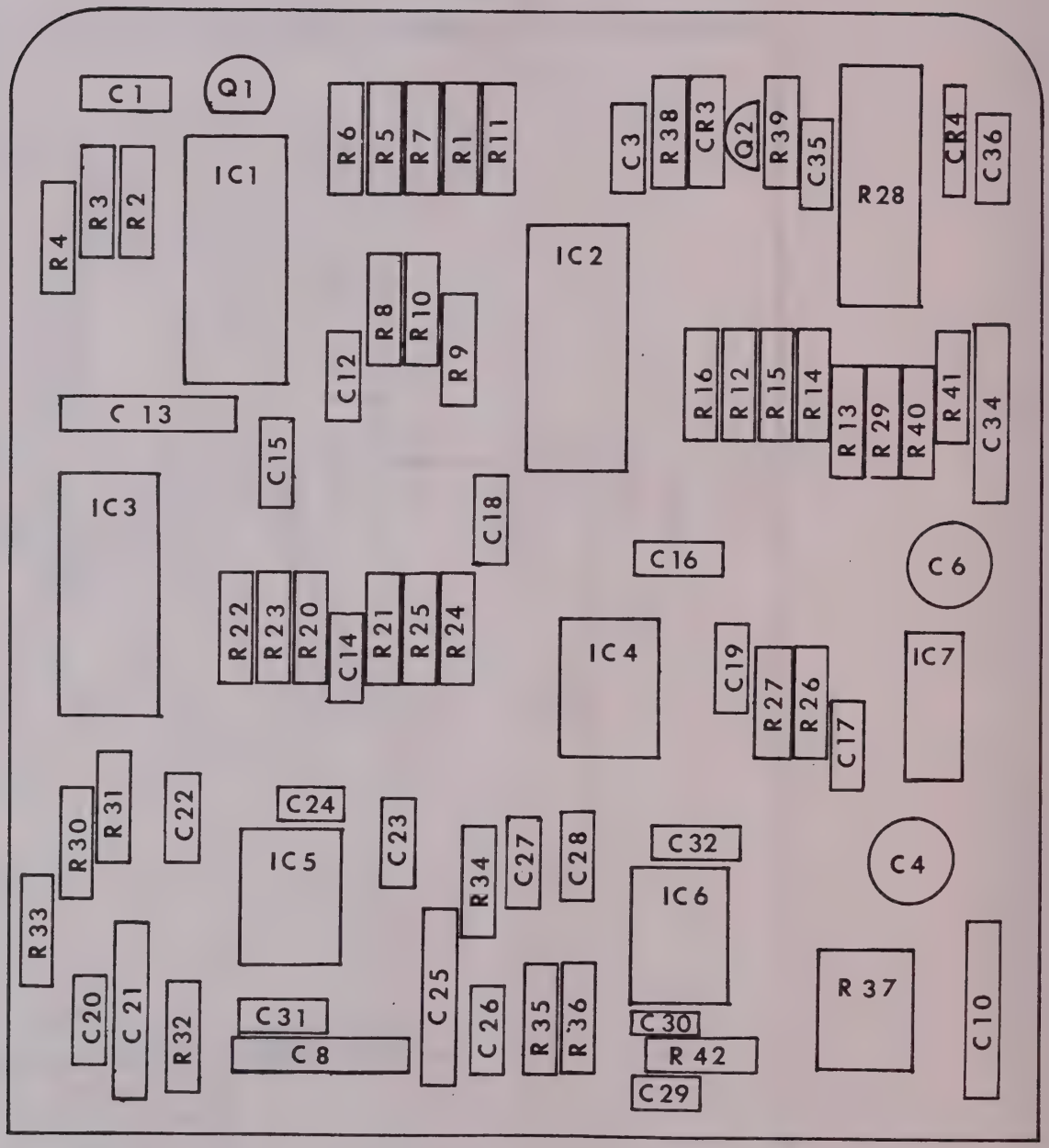

C1
Q1
R6
R5
R7
R1
R11
C3
R38
CR3
Q2
R39
C35
R28
CR4
C36
IC1
R4
R3
R2
IC2
R8
R10
R9
C12
R16
R12
R15
R14
R13
R29
R40
R41
C34
C13
C15
IC3
C18
C16
C6
R22
R23
R20
C14
R21
R25
R24
IC4
C19
R27
R26
C17
IC7
R30
R31
C22
C24
IC5
C23
R34
C27
C28
C32
C4
R33
IC6
C20
C21
R32
C31
C8
C25
C26
R35
R36
C30
R42
C29
R37
C10

M44-1
FM DISCRIMINATOR

REV ___

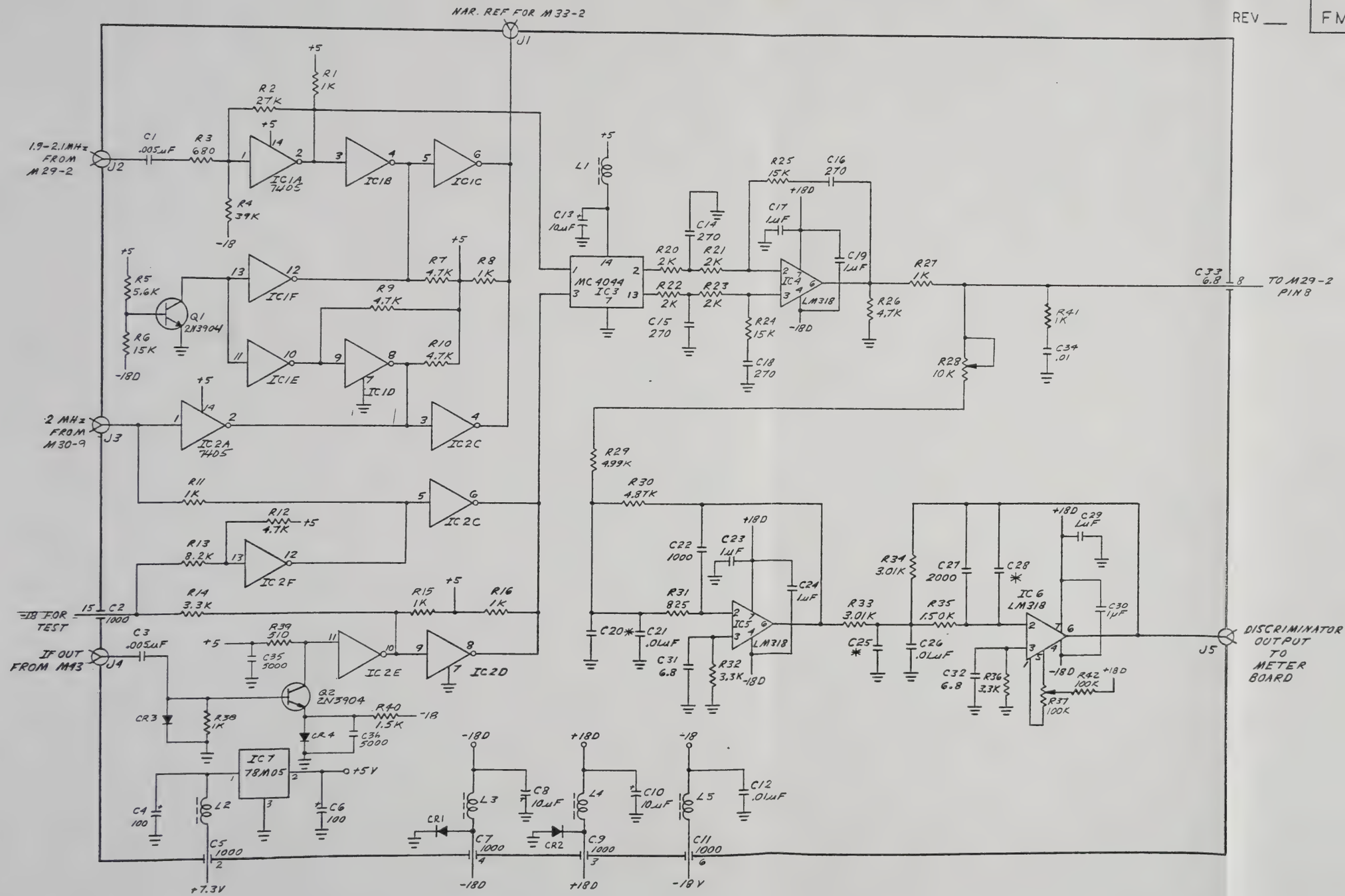


M44-1

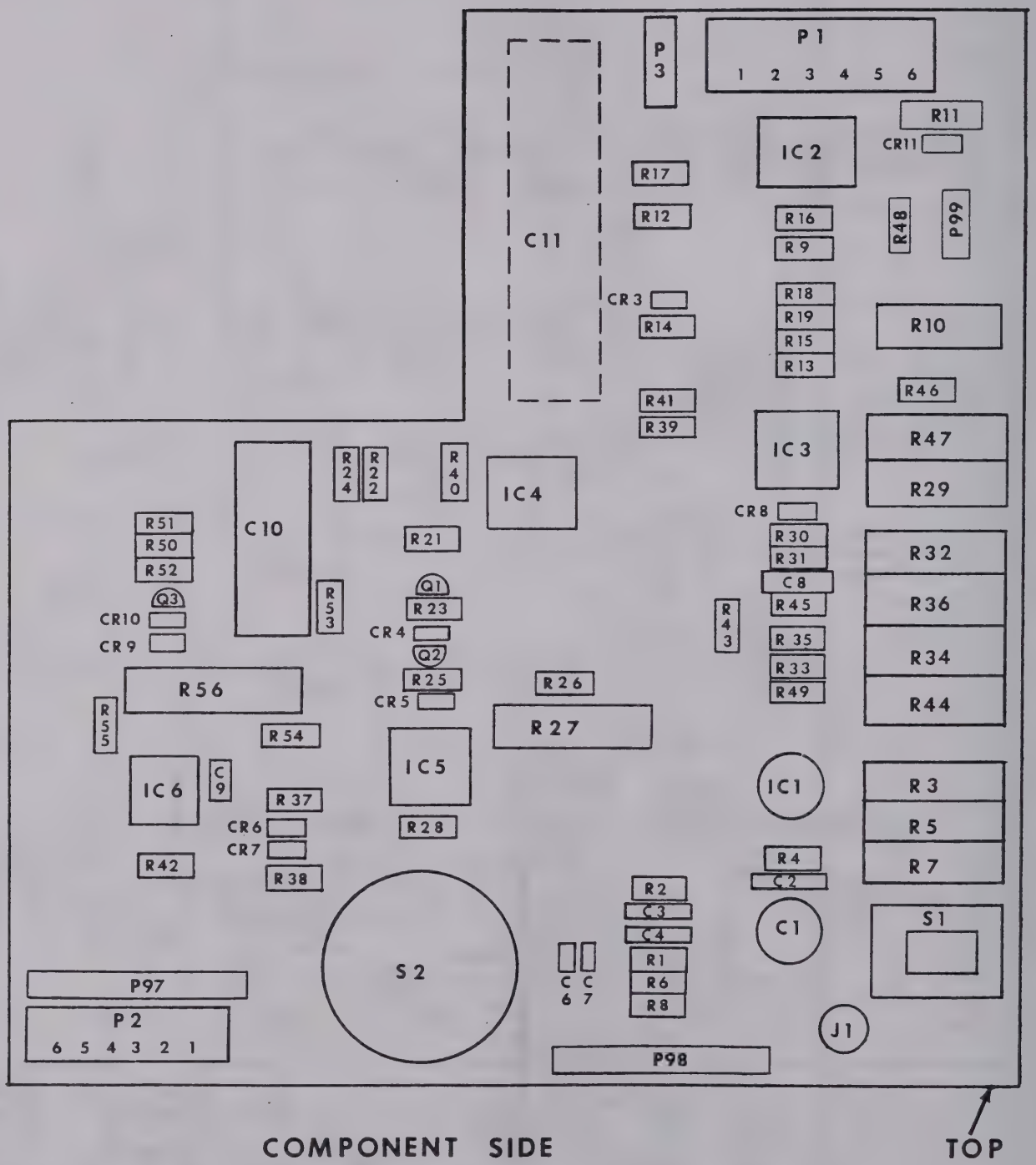

C1
Q1
R6
R5
R7
R1
R11
C3
R38
CR3
Q2
R39
C35
R28
CR4
C36
IC1
R4
R3
R2
IC2
R8
R10
R9
C12
R16
R12
R15
R14
R13
R29
R40
R41
C34
C13
C15
IC3
C18
C16
C6
R22
R23
R20
C14
R21
R25
R24
IC4
C19
R27
R26
C17
IC7
R30
R31
C22
C24
IC5
C23
R34
C27
C28
C32
IC6
C4
R33
C20
C21
R32
C31
C8
C25
C26
R35
R36
C30
R42
C29
R37
C10

M44-1
FM DISCRIMINATOR

REV ___

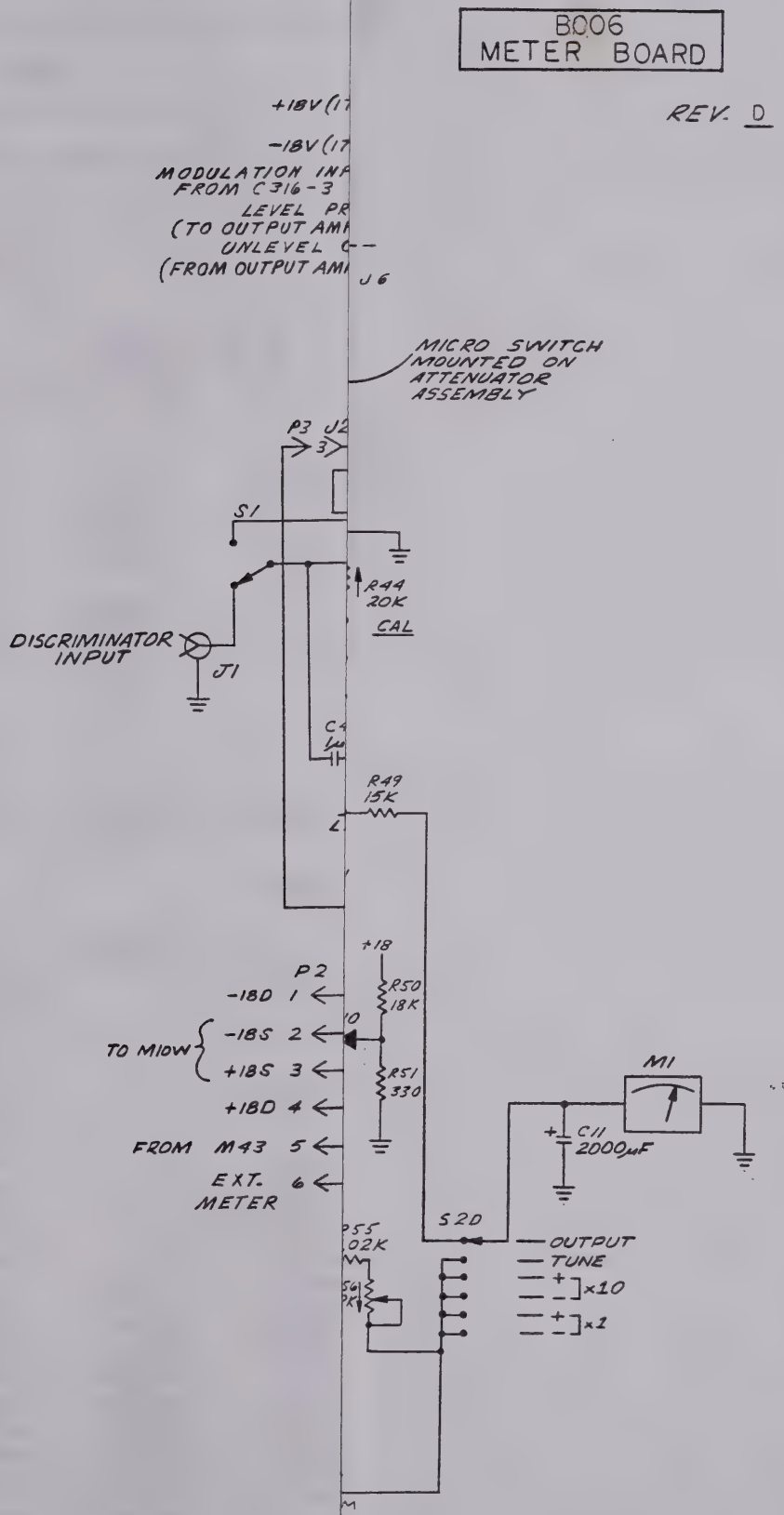


METER BOARD
B006

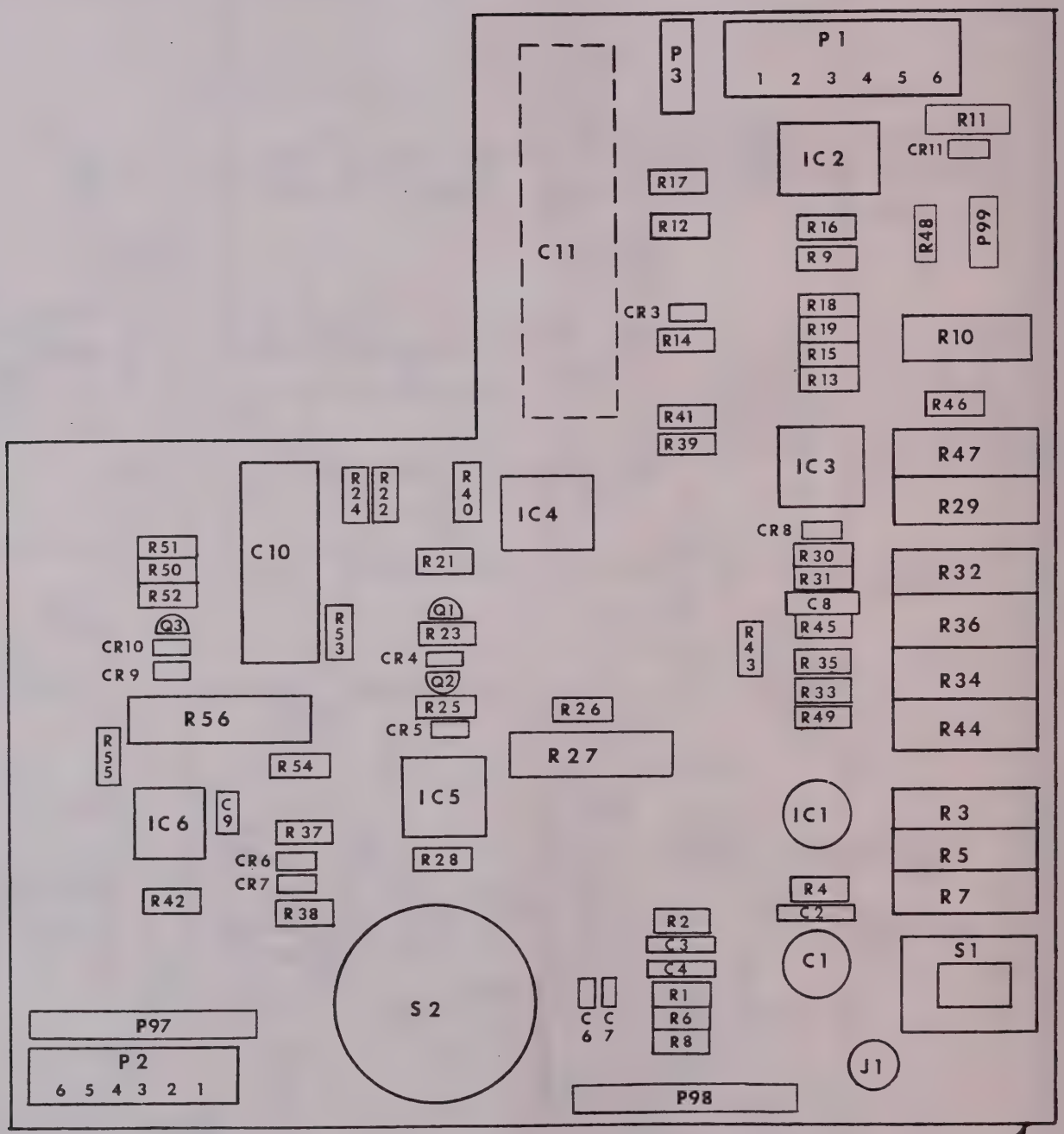


COMPONENT SIDE

TOP


B006
METER BOARD
REV. D
+18V(17
-18V(17
MODULATION INP
FROM C316-3
LEVEL PR
(TO OUTPUT AMP
UNLEVEL C--
(FROM OUTPUT AMP
J6
MICRO SWITCH MOUNTED ON ATTENUATOR ASSEMBLY
P3 J2
3
S1
R44 20K
CAL
DISCRIMINATOR INPUT
J1
C4
1μ
R49 15K
+18
P2
-18D 1
-18S 2
TO M10W
+18S 3
+18D 4
FROM M43 5
EXT. METER 6
R50 18K
10
R51 330
M1
C11 2000μF
S2D
OUTPUT TUNE
×10
×1
P55
02K
50
2K

METER BOARD
B006



COMPONENT SIDE

TOP

B006
METER BOARD

REV. D

P1
+18V(17ma) — 6 — +18
-18V(17ma) — 5 — -18
MODULATION INPUT FROM C316-3 — 4
LEVEL PROG. (TO OUTPUT AMPLIFIER) — 3
UNLEVEL CKT. (FROM OUTPUT AMPLIFIER) — 2
1

P3 J2
CR1 G
CR2 R
UNLEVELED
DEVIATION LEVEL
J2 P3

S1
DISCRIMINATOR INPUT J1

R1 20K
C1 3-13
C2 10
R4 1M
C3 20
C4 1μF
R2 1M
IC1 LF355
+18 -18
R3 20K
OC BAL
x10 CAL
R6 9.1K
R5 2K
R7 2K
R8 910
x1 CAL

S2A S2B

+18
R9 36.5K
R14 33K
CR3
R18 20K
R19 2.74K
R15 10.0K
% MOD
R10 5K
R13 7.5K
MC1458P1
IC2A
R12 10.0K
R16 11.3K
R48 1.2K
-18V
R11 100
CR11
R17 3.92K
-18

-4.9
VERNIER
IC2B
R20 10K
MC1458P1
-1.3

IC3A MC1458P1

LEVEL SET-UP

R29 20K
R30 5.6K
R31 220K
R32 20K
R39 10K
+10 dBm RANGE
IC4A MC1458P1

J5 J6 S3
MICRO SWITCH MOUNTED ON ATTENUATOR ASSEMBLY

IC4B MC1458P1
J7
R33 33K
R34 20K
R35 1M
R36 20K
R40 10K
0 dBm RANGE

R43 68K
R45 100K
R44 20K CAL
C8 .47μF
CR8

R41 20K
IC3B MC1458P1
R46 15.8K
R47 2K
BAL
R49 15K

P2
-18D 1
-18S 2
+18S 3
+18D 4
FROM M43 5
EXT. METER 6
TO M10W

S2E S2F

Q1 MPS3702
CR4
R21 12K
R22 3.9K
Q2 2N3904
CR5
R23 12K
R24 3.9K
R25 10K
IC5A MC1458P1
R26 10K
R27 2K
R28 10K
CR6
CR7
IC5B MC1458P1

R37 10.0K ‡
R38 10.0K ‡
S2C

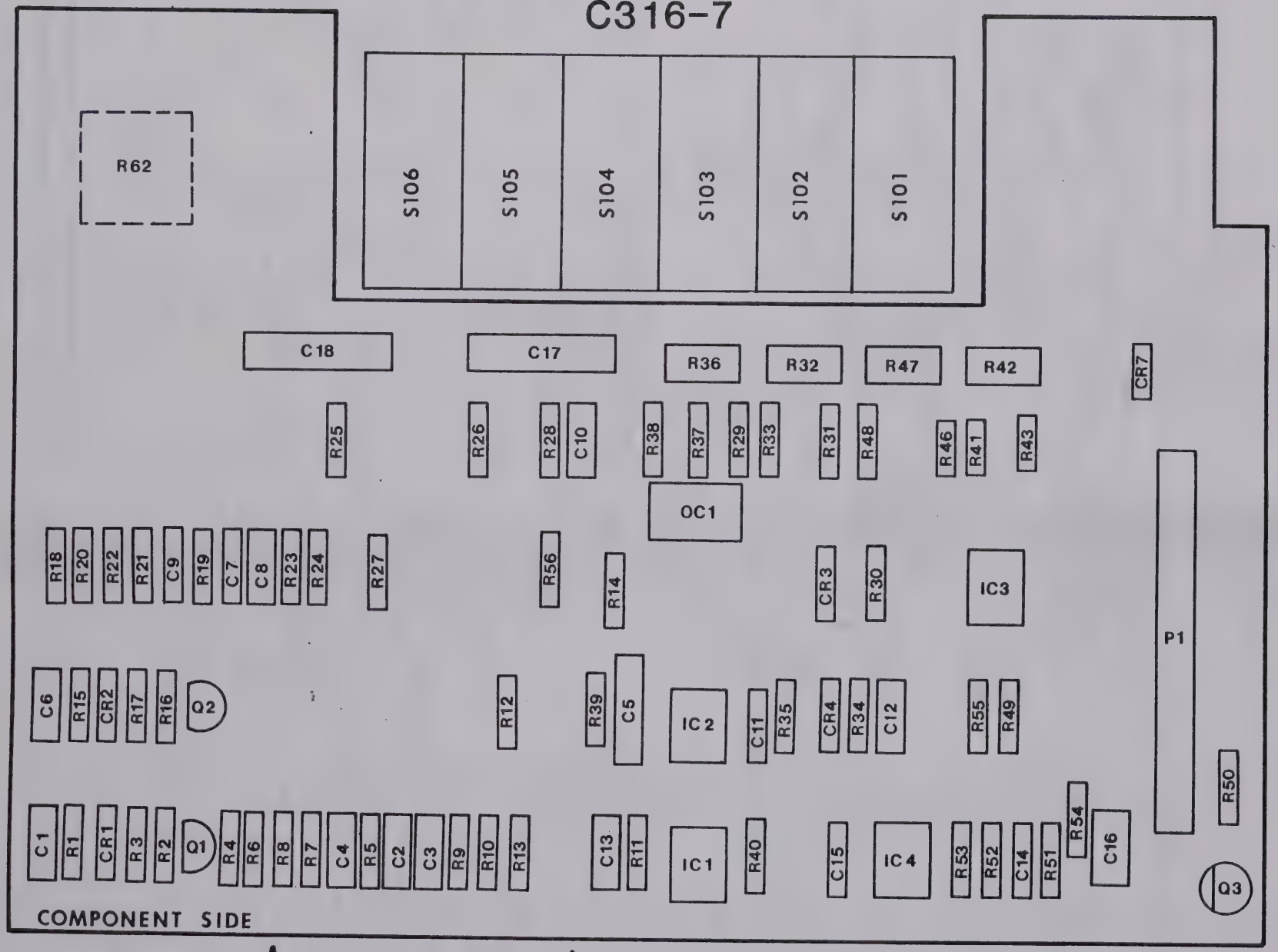
IC6 LM318
C9 .01μF
R42 22K
CR9
Q3 2N5458
R52 2.2K
R53 10M
C10 .15μF
R54 47K
R55 4.02K
R56 2K

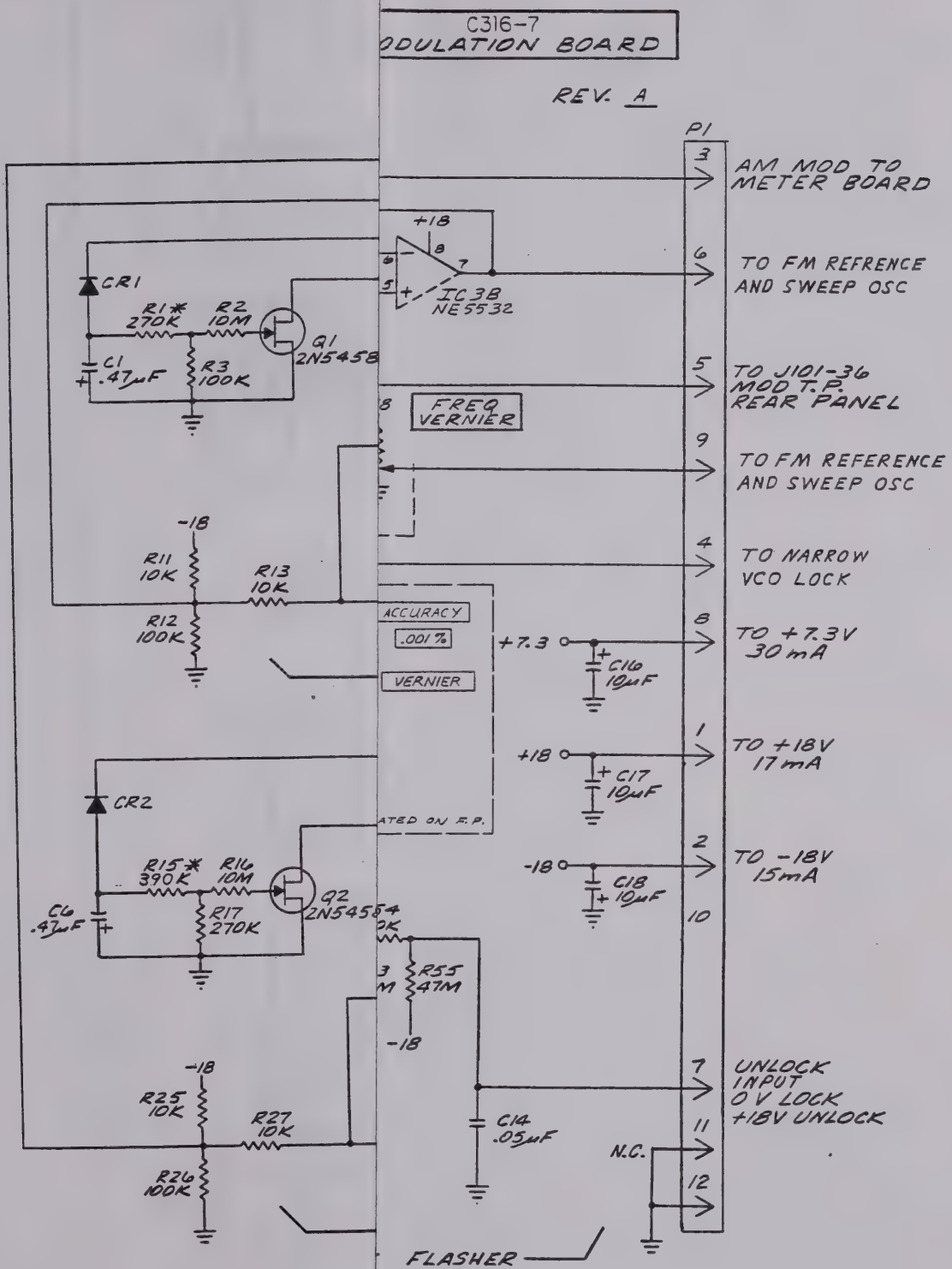
R50 18K
CR10
R51 330
S2D
M1
C11 2000μF
OUTPUT
TUNE
×10
×1

R57 1.5M

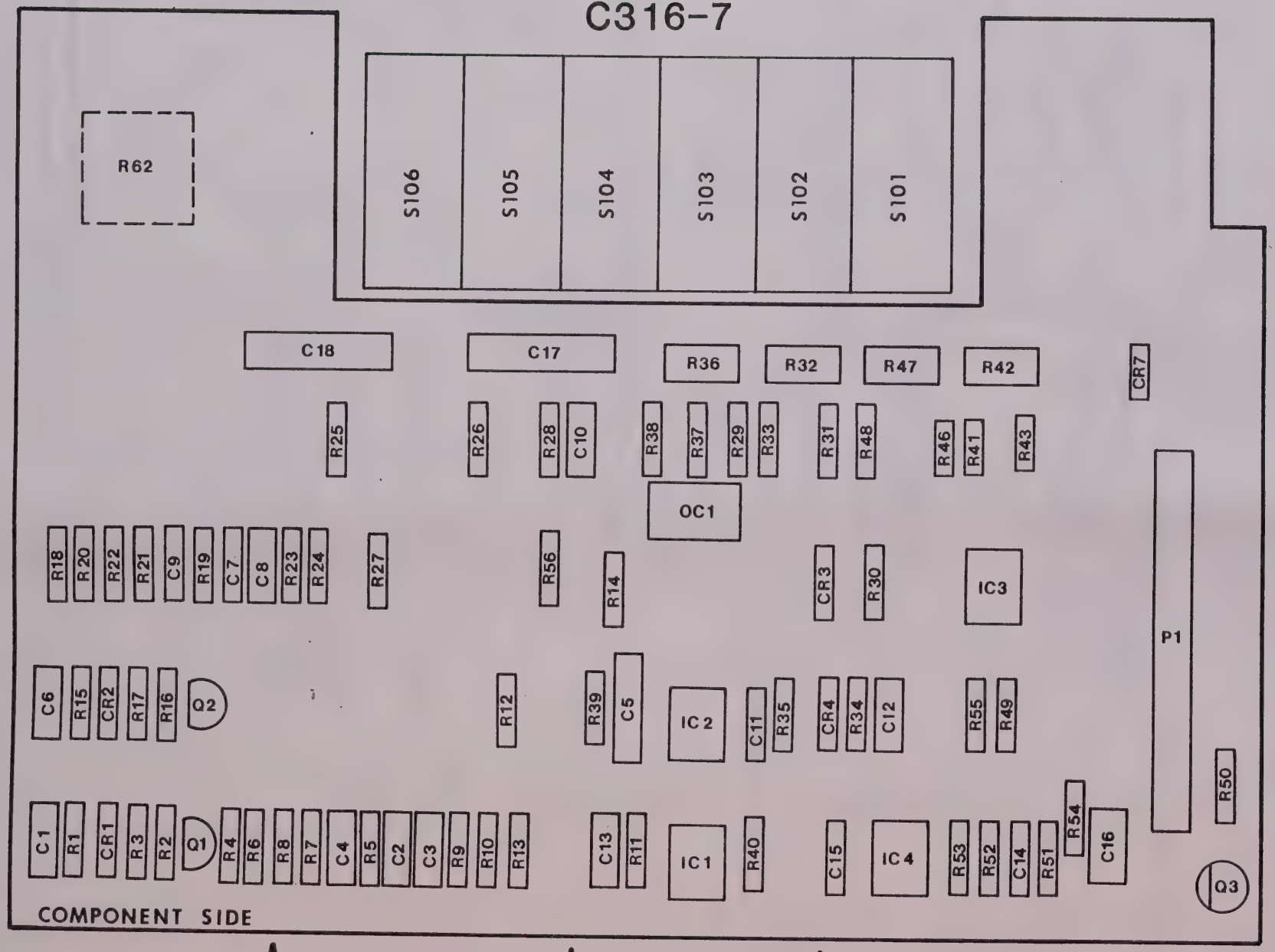
‡MATCHED 0.1 %

C316-7


R62
S106
S105
S104
S103
S102
S101
C18
C17
R36
R32
R47
R42
CR7
R25
R26
R28
C10
R38
R37
R29
R33
R31
R48
R46
R41
R43
OC1
R18
R20
R22
R21
C9
R19
C7
C8
R23
R24
R27
R56
R14
CR3
R30
IC3
P1
C6
R15
CR2
R17
R16
Q2
R12
R39
C5
IC 2
C11
R35
CR4
R34
C12
R55
R49
R50
C1
R1
CR1
R3
R2
Q1
R4
R6
R8
R7
C4
R5
C2
C3
R9
R10
R13
C13
R11
IC1
R40
C15
IC 4
R53
R52
C14
R51
R54
C16
Q3
COMPONENT SIDE
R44 *
AM/FM
MODULATION
VERNIER
S1 *
MODULATION
FREQUENCY
SWITCH
S 2 *
MODULATION
MODE
SWITCH


C316-7
ODULATION BOARD
REV. A
P1
3
AM MOD TO METER BOARD
+18
6
TO FM REFRENCE AND SWEEP OSC
IC3B NE5532
CR1
R1* 270K
R2 10M
Q1 2N5458
C1 .47μF
R3 100K
5
TO J101-36 MOD T.P. REAR PANEL
FREQ VERNIER
9
TO FM REFERENCE AND SWEEP OSC
-18
R11 10K
R13 10K
4
TO NARROW VCO LOCK
R12 100K
ACCURACY
.001%
VERNIER
+7.3
C16 10μF
8
TO +7.3V 30mA
1
TO +18V 17mA
+18
C17 10μF
CR2
ATED ON F.P.
2
TO -18V 15mA
-18
C18 10μF
R15* 390K
R16 10M
Q2 2N5458
C6 .47μF
R17 270K
10
R55 47M
-18
-18
R25 10K
R27 10K
7
UNLOCK INPUT
0V LOCK
+18V UNLOCK
C14 .05μF
11
N.C.
R26 100K
12
FLASHER

C316-7


R62
S106
S105
S104
S103
S102
S101
C18
C17
R36
R32
R47
R42
CR7
R25
R26
R28
C10
R38
R37
R29
R33
R31
R48
R46
R41
R43
OC1
R18
R20
R22
R21
C9
R19
C7
C8
R23
R24
R27
R56
R14
CR3
R30
IC3
P1
C6
R15
CR2
R17
R16
Q2
R12
R39
C5
IC 2
C11
R35
CR4
R34
C12
R55
R49
R50
C1
R1
CR1
R3
R2
Q1
R4
R6
R8
R7
C4
R5
C2
C3
R9
R10
R13
C13
R11
IC1
R40
C15
IC 4
R53
R52
C14
R51
R54
C16
Q3
COMPONENT SIDE
R44 *
AM/FM
MODULATION
VERNIER
S1 *
MODULATION
FREQUENCY
SWITCH
S2 *
MODULATION
MODE
SWITCH

C316-7
MODULATION BOARD

REV. A

MODULATION FREQUENCY
S1
DC
400 Hz
1000 Hz
EXT.

MODULATION MODE
S2
CW
AM
FM x 1
FM x 10

FM / AM MODULATION SLIDER
R44 10K
IC3A NE5532

R46 10.5K
FMX1
R47 1K
R48 1.5K
IC3B NE5532
+18

R49 1K

FREQ VERNIER
R62 10K

EXT. MOD INPUT

R56 620

R43 5.11K
R42 1K 5V ADJ
R41 2.74K

CR1
R1* 270K
R2 10M
R3 100K
C1 .47µF
Q1 2N5458
R4* 5.6M
R5 10M
R6 4.7M
TP2
C2 470
C3 470
R7* 1M
R8 178K
C4 1000
R10 340K
R9 340K
R11 10K
R12 100K
R13 10K
C5 330
R14 470K
IC1A RC4558B
1000 Hz OSC.

R40 680K *
C13 .47µF
R39 18K
R38 47K
R37 10M
BALANCE
R36 20K
IC1B RC4558B
TP1

CR2
R15* 390K
R16 10M
R17 270K
C6 .47µF
Q2 2N5458
R18* 5.6M
R19 22M
R20* 22M
TP3
C7 470
C8 470
R21* 4.7M
R22 464K
C9 1000
R24 845K
R23 845K
R25 10K
R26 100K
R27 10K
C10 1000
R28 560K
IC2A RC4558
400 Hz. OSC.

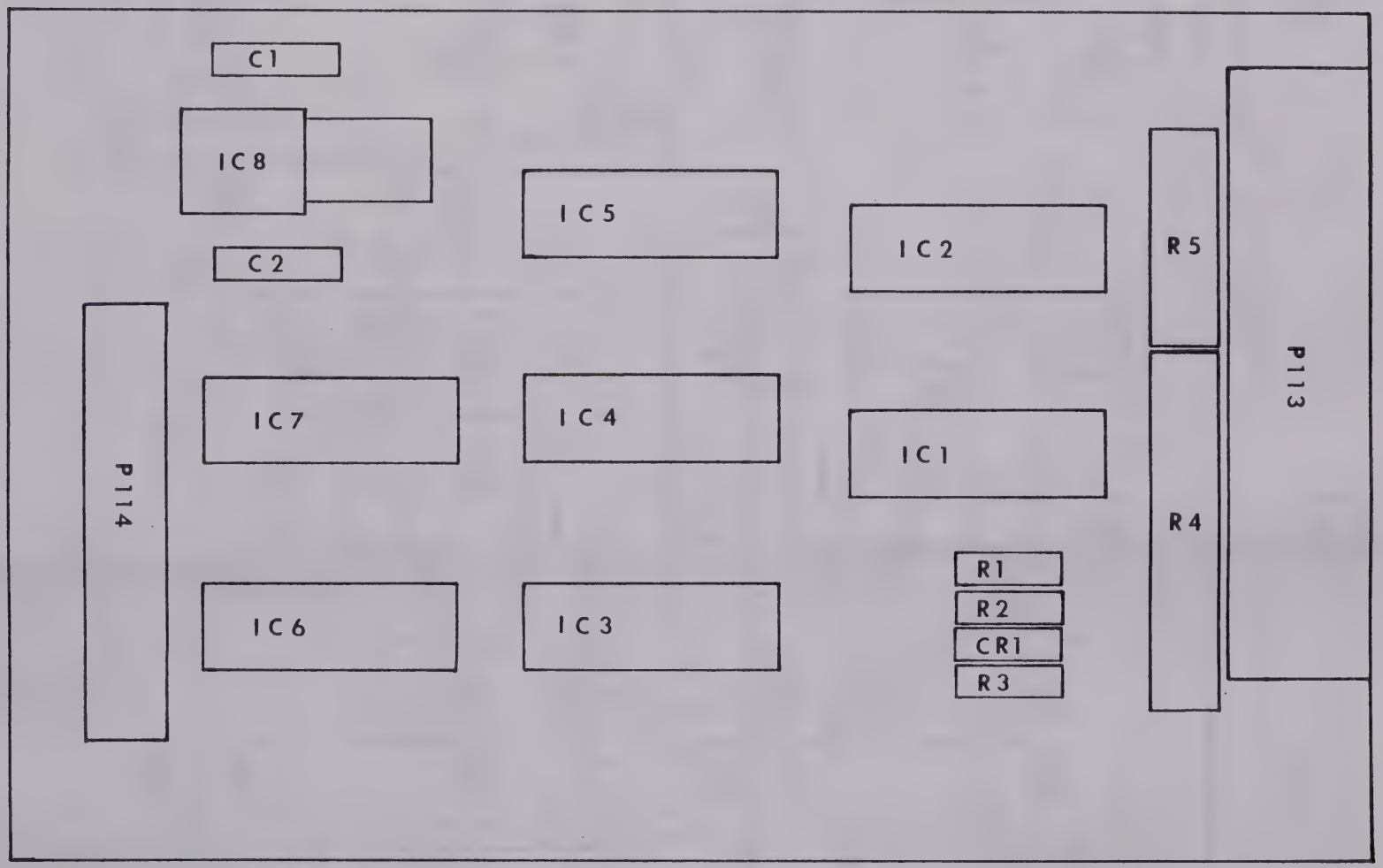
R29 7.5K
OC-1
C11 .001µF
IC2B RC4558
TP4
R35 1M
CR4
C12 .47µF
R34 1M
CR3
R30 270K
R31 4.87K
SIZE
R32 1K
R33 12.1K

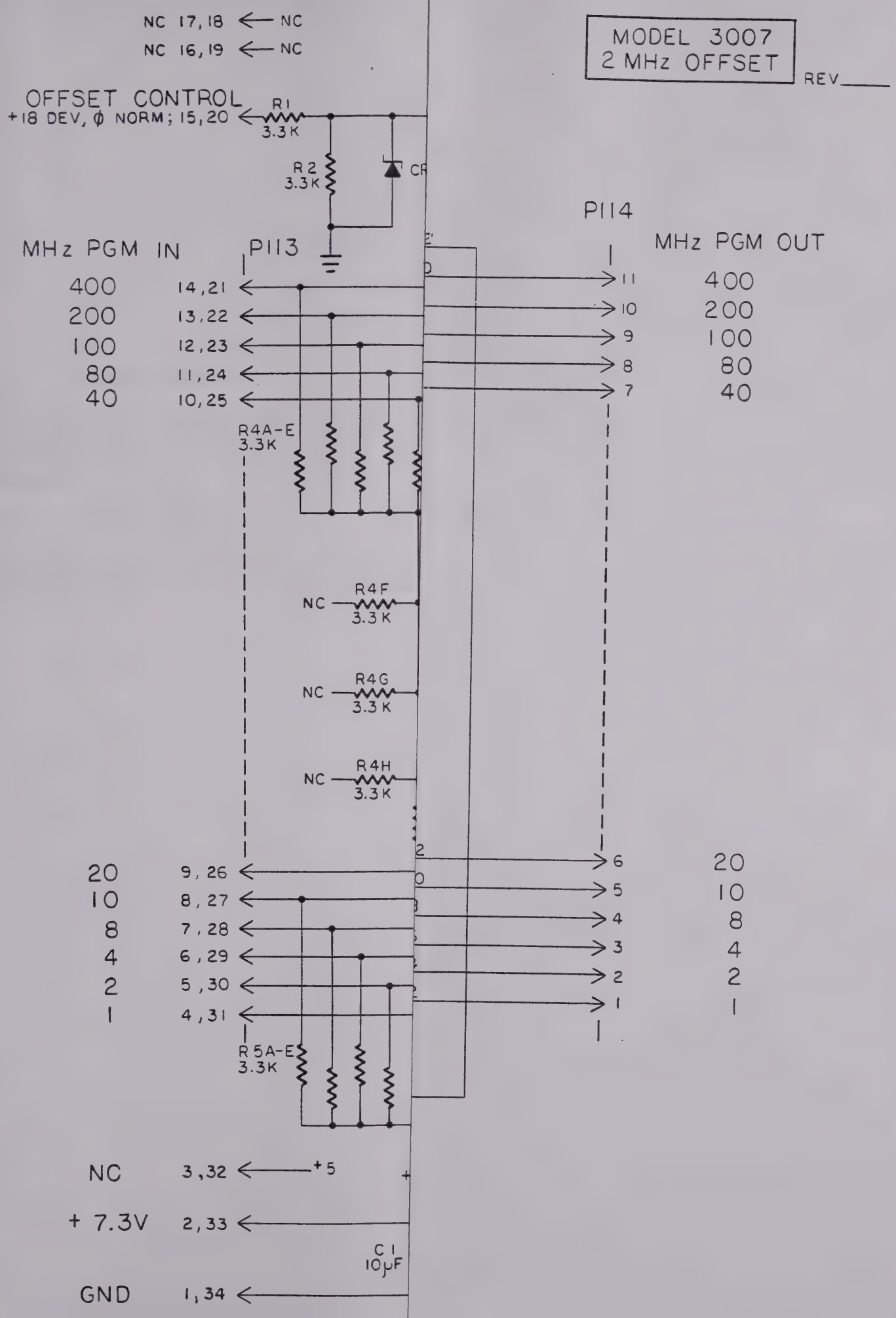
+7.3
S3
CR7
CR6
CR5
ACCURACY
.001%
VERNIER
PARTS LOCATED ON F.P.
C16 10µF
C17 10µF
C18 10µF

R50 200
Q3 2N3904
R51 4.7K
R52 330
IC4 MC1455
R54 100K
R53 22M
R55 47M
C15 .01µF
C14 .05µF
UNLOCK FLASHER

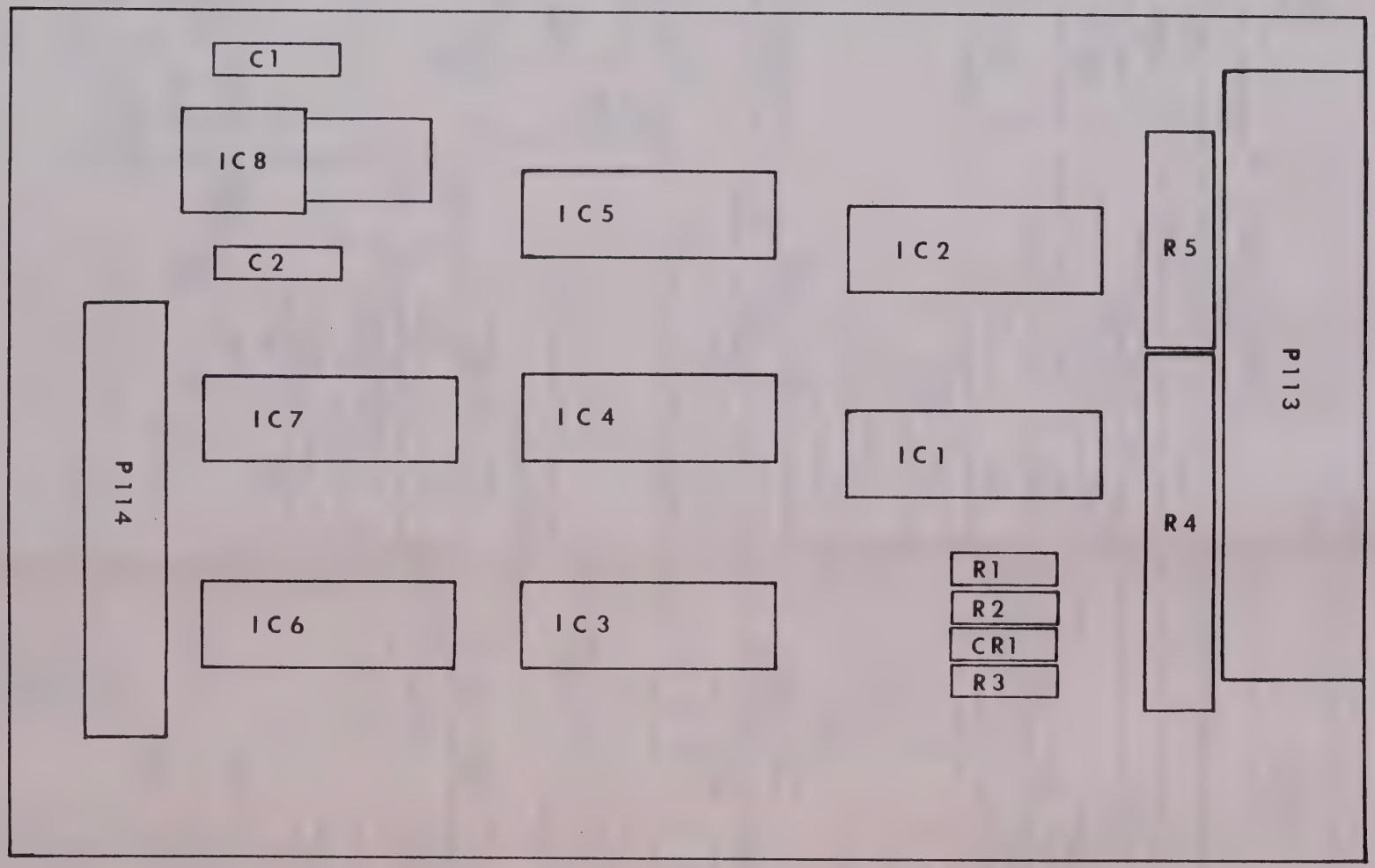
P1
3 AM MOD TO METER BOARD
6 TO FM REFRENCE AND SWEEP OSC
5 TO J101-36 MOD T.P. REAR PANEL
9 TO FM REFERENCE AND SWEEP OSC
4 TO NARROW VCO LOCK
8 TO +7.3V 30 mA
1 TO +18V 17 mA
2 TO -18V 15 mA
10
7 UNLOCK INPUT 0 V LOCK +18V UNLOCK
11 N.C.
12

2 MHz OFFSET BOARD




NC 17,18 ← NC
NC 16,19 ← NC
MODEL 3007
2 MHz OFFSET
REV
OFFSET CONTROL
+18 DEV, ϕ NORM; 15,20
R1
3.3K
R2
3.3K
CR
P114
MHz PGM IN
P113
MHz PGM OUT
400
200
100
80
40
14,21
13,22
12,23
11,24
10,25
11
10
9
8
7
400
200
100
80
40
R4A-E
3.3K
NC
R4F
3.3K
NC
R4G
3.3K
NC
R4H
3.3K
20
10
8
4
2
1
9,26
8,27
7,28
6,29
5,30
4,31
6
5
4
3
2
1
20
10
8
4
2
1
R5A-E
3.3K
NC
3,32
+5
+ 7.3V
2,33
C1
10μF
GND
1,34

2 MHz OFFSET BOARD



NC 17,18 ← NC

NC 16,19 ← NC

MODEL 3007
2 MHz OFFSET

REV____

OFFSET CONTROL
+18 DEV, ϕ NORM; 15,20 ← R1 3.3K

R2 3.3K

CR1

R3 1K

MHz PGM IN

P113

400	14,21
200	13,22
100	12,23
80	11,24
40	10,25

R4A-E 3.3K

NC R4F 3.3K +5

NC R4G 3.3K

NC R4H 3.3K

R4I 3.3K

20	9,26
10	8,27
8	7,28
4	6,29
2	5,30
1	4,31

R5A-E 3.3K

IC1 MC14069

IC2 MC14069

IC3 MC14560 (A3, A2, A1, A0, C, C IN, S3, S2, S1, S0; NC, NC)

IC4 MC14560 (A3, A2, A1, A0, COUT, S3, S2, S1, S0)

IC5 MC14560 (A3, A2, A1, A0, B1, COUT, S3, S2, S1, S0)

IC6 7404

IC7 7404

P114

MHz PGM OUT		
400	11	
200	10	
100	9	
80	8	
40	7	
20	6	
10	5	
8	4	
4	3	
2	2	
1	1	

NC 3,32 ← +5

+7.3V 2,33

GND 1,34

IC8 78M05

C1 10μF

C2 10μF

NOTE: ALL CONNECTIONS ON MC14560 NOT SHOWN ARE TIED TO GROUND.

8.1 INTRODUCTION

This section contains descriptions of engineering updates as well as corrections as to any errors in the manual.

8.2 MANUAL CHANGES

Wavetek's product improvement program incorporates the latest electronic developments into these instruments as rapidly as development and testing permit. Due to the time required to document and print these instruction manuals, it is not always possible to include the changes in the original printing. Change information, if any, appears at the end of this section.

Wavetek's product improvement program incorporates the latest electronic developments into these instruments as rapidly as development and testing permit. Due to the time required to document and print these instruction manuals, it is not always possible to include the changes in the original printing. The following schematics and drawings have been changed.

TYPOGRAPHIC ERRORS:

Page 4-8, Step 3 — "_3" should read "+3"

Page 4-9, Section 4.5.3, Step 5 — "Set video filter to 100 Hz...." should read "Set the vertical display to 1 dB per division, and adjust video filter to reduce noise on trace."

Page 5-10, Section 5.3.17, 4th line from bottom — "5.535 ±.005" should read "3.535 ±.005"

Page 5-17, Table 5-1, Column 5, "MEASURED AT" should read:
"M30-1/4 (W11)
M30-1/4 (W13)
M30-1/4 (W15)
M9W (W18)
M30-1/4 (W17)
M30-1/4 (W12)
M44-1 (W5)
M9W (W19)
M32A (W20)
M30-1/4 (W16)
M31A (W21)"

11/15/84 M34 SCHEMATIC
M34 Schematic should indicate C13*.

11/14/85 M9W to M9W-7
The M9W-7 Sweep Oscillator module replaces the M9W module in the Model 3007 Signal Generators. The M9W-7 module uses a control circuit to automatically set the phased-locked loop voltage in PLL3 to zero. This eliminates the Pot "D" adjustment in the M9W module. Disregard the first paragraph of Section 5.3.7 in the manual, since there is no pot "D". The M9W-7 parts list and schematic replace the M9W documents may be found at the end of the Manual Changes.

1/7/86 5.3.6 PHASE-LOCKED LOOP 2 ADJUSTMENT M32A
Revise the first paragraph beginning with line 3 to read:

Connect a digital voltmeter to M32A PIN 14. The DVM should read between +0.5 and +2.5 VDC. If the leveler voltage is within this

range, DO NOT adjust the M30-# trimmer capacitors. (The dash number # depends upon the instrument model number.)

If the leveler voltage is not between +0.5 and +2.5 VDC, carefully adjust trimmers A and B on top of the M30-# until the voltage is correct.

CAUTION: If trimmers A and B are adjusted too far, the trimmer screws may fall down into the module. Misadjusted trimmers may cause faulty phase-locked loop 2 operation.

If the M32A leveler voltage cannot be correctly adjusted, proceed as follows. Disconnect the module cable W9 on the 1440 MHz output connector on the M30-#. This connector is next to the A trimmer. Connect the 1440 MHz output to the RF input of a spectrum analyzer, and note the 1440 MHz comb line amplitude. It should be -12 dBm or greater. The adjacent 1320 and 1560 MHz comb lines should be at least 20 dB below the 1440 MHz comb line. Adjust trimmers A and B only if the comb lines are not as stated above. Remove the spectrum analyzer input, and reconnect cable W9 to the 1440 MHz output connector.

Set the Leveler/Indicator switches to 239.000 MHz, and note that the DVM reading is still within the above limits.

If correct M30-# comb lines are obtained, and the M32A leveler is incorrect, the M32A module or cable W9 is faulty. If, after adjustment, the M30-# comb lines are incorrect, the M30-# is faulty. If replacement modules are available, they may be substituted to correct the fault. The M30-# must have the correct dash number.

PIN 4234 REPLACEMENT OF DUAL SPDT SLIDE SWITCH
1-7-88 The dual SPDT slide switch formerly used in this unit has been replaced. Make the following changes in the manual:

On the parts list for the Meter Board Subassy, B006, (parts list # 1218-00-0760) replace the current line for reference designator S01 with the following line (column entries separated by semicolons):

"S01; SLIDE SWITCH; GF126; C-W; 5105-00-0001; 1.000"

REVISIONS A THROUGH D HAVE BEEN INCORPORATED INTO THIS MANUAL.

Rev E REPLACE M31A MODULE WITH M31B MODULE
12/14/87
PIN 4267 The M31A module is now obsolete. It has been replaced with the M31B. Replace all text references to the "M31A" with "M31B". Change "M31A" to "M31B" on the wiring diagram schematic.

Replace the M31A schematic (Wavetek number 0014-40-0061) with the M31B schematic (0014-30-0406) from the following section.

On parts list SGL GEN 3007 (1010-00-0224), change the ORIG-MFGR-PART-NO column entry from "M31A" to "M31B" on the line for reference designator ZA08 and change the Wavetek part number column entry from "1114-00-0465" to "1114-00-0530". Replace parts lists KHZ STEPS, M31A, (1114-00-0465) and PC ASSY, M31A (1218-00-1700) with parts lists KHZ STEPS, M31B (1114-00-0530) and PC ASSY, M31B (1218-00-2607).

Rev F CAPACITOR ADDITION, M31B MODULE
02/26/88
PIN 4301 The "1000pF" capacitor shown at J1 (the 1 kHz reference input) on the M31B schematic (Wavetek number 0014-30-0406) is a star value component of nominal value 1000 pF. It will be absent on most units.

Rev G REPLACE .1 UF CAPACITORS IN PARTS LISTS
1/23/89
PIN 4661 In parts lists numbers 1114-00-0469, and 1114-00-0514, replace the .1UF capacitors with part number "1510-00-3104" by .1 UF capacitors with part number "1510-06-7104". Change the manufacturer information shown in the parts lists to show the following (column entries separated by semicolons):

Ref designator(s) as required;CAP,CER,.1UF,50V,20%;12015C104MAT050M; AVX;1510-06-7104;Quantity (QTY) as required

Rev H FLATNESS TEST, SECTION 4.5.2
2/23/89
PIN 4670 Replace step 4 of this test with the following:
"Set the signal generator frequency selector in 10 MHz steps from 10 MHz to 520 MHz. Observe the change in power meter reading. Note the maximum and minimum power reading. Subtract the minimum power reading from the maximum reading and divide by two. The result should be .75 dB or less. Record the change on the PTR (Performance Test Record) at the end of section 4.

REV I REPLACE RF CKT BKR, M35-2 PARTS LISTS
3/10/89 Replace RF CKT BKR, M35-2 Parts List 1114-00-0225 in Section 6
PIN 4675 with RF CKT BKR, M35-2 Parts List 1114-00-0225 located at the rear off this addendum. Update the associated RF CIRCUIT BREAKER M35-1/2 schematic in Section 7 according to the new parts lists.

5/5/89 The new M31B kHz Steps circuitry added earlier (Rev E, PIN 4267),
PIN 4707 has been changed. On the new M31B schematic at the rear of this addendum, change IC9 to an "MC4044P". On parts list PC ASSY, M31B at the rear of this addendum, replace the line beginning "IC09" with the following line (column entries separated by semicolons):

"IC09;PHASE DETECTOR*SS*;MC4044P;MOT;8000-40-4400;1.000"

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
A01	PC ASSY, M31B	M31B-PC	W-I	1218-00-2607	1.000
A02	MECH,B,M31A	MECH-B-M31A	W-I	1216-00-0046	1.000
C17	CAP,ALM,100UF,16V 20%,AXL.312"DX.687"L	TT16M100A	MAL	1510-21-2101	1.000
C18	CAP,ALM,100UF,6.3V 20%,AXL.312"DX.687"L	KE1-100/6.3	FRK	1510-21-1101	1.000
C19 C20 C25 C28 C32 C37	CAP,TNT,10uF,25V, 20%,AXL,D=3% .18"x.345"	173D106X0025W	SPR	1510-21-7100	6.000
CR04	LED,RED,T-1-3/4 V=5.0V,IF=70mA Int=1.5mcd,*SS*	HLMP-3300	H-P	4810-02-0001	1.000
IC13	POS. VOLT REG-3 TERM PLAS,TO-220AB,5 VOLT 500mA,7 W,5%,3-TERM	S78M05CV	SIG	7000-78-0500	1.000
J01 J02	SMC,SCREW-ON,50 OHM BULKHEAD,RECEPTACLE	37JR116-1	S-C	2110-03-0002	2.000
L01 L02 L03 L04 L05 L06 L07 L08 L09 L10 L11 L12	TOROID,10T	LA009-010	W-I	1810-05-0002	12.000
L13 L14 L15 L16	TOROID,10T,3-1/4L	LA009-010-4	W-I	1810-05-0007	4.000
R30	(O)RES,C,1/4W,5%1.8K USE P/N:4701-03-1821	CF1/4-1.8K	KOA	4700-15-1801	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
C21 C22 C27 C29	CAP,FILM,.12uF,100V 5%,RAD.36"Hx.40"LS	MC124JIC	NPC	1510-60-8124	4.000
C23 C24 C26	CAP,CER,1uF,50V 20%,RAD,Z5U .36"H,.20"LS	CZ30C105M	C-L	1510-11-3105	3.000
C30	CAP,MICA,1000PF,100V 5%,RAD.40"HX.23"LS	DM15-102J	ARC	1510-50-6102	1.000
C31	CAP,CER,10PF,1KV 5%,RAD,NPO,T/R .30"DX.16"T,.25LS	10TCCQ10	SPR	1510-10-0100	1.000
C33 C34	CAP,MICA,180pF,500V 5%,RAD.46"Hx.23"LS	DM15-181J	ARC	1510-50-0181	2.000
C35	CAP,CER,1000pF,1KV 10%,RAD,Z5R,T/R .39"Dx.16"T,.25"LS	5GAD10	SPR	1510-10-1102	1.000
C36	CAP,CER,.01uF,100V 20%,RAD,Z5U,T/R .39"Dx.16"T,.25"LS	TGS10	SPR	1510-10-2103	1.000
CR01	(O)DIODE,HI CAP,VART TO-92,CT=120pF,*SS*	MV2301	MOT	4803-02-0008	1.000
CR02 CR03 CR05	DIODE,SIGNAL,GP AXIAL,V=75V,IO=10mA CT=4pF,*SS*	1N914	G-E	4807-01-0914	3.000
IC01 IC02 IC12	HEX,INV,TTL PLAS,DIP-14*SS*	SN7404N	T-I	8000-74-0400	3.000
IC03 IC04 IC05 IC06	CNTR/LCH/PRS,DECADE, PLAS,DIP-14, LW SCHOTTKY,*SS*	SN74LS196N	T-I	8007-41-9610	4.000
IC07	DUAL J-K, NEG, FLIP-FLOP	SN74LS112AN	T-I	8007-41-1210	1.000
IC08	TRIPLE POS AND*SS*	SN74LS11N	T-I	8000-74-1110	1.000
IC09	PHASE DET,FCD ONLY *SS*	11C44DC ONLY	FCD	8000-11-4400	1.000
IC10	OP AMP,JFET INPUT PLAS,DIP-8,18Vdc 13V/uS,*SS*	TL082CP	T-I	7000-00-8200	1.000
IC11	OP AMP,HIGH PERF PLAS,DIP-8,18Vdc .5V/uS,Vos=2mV,*SS*	N5741CV	SIG	7000-57-4100	1.000
L17	CHOKE,COATED,2.2UH 10%,D=0.120IN L=0.300IN,I=395MA	08N2R2	JEF	1810-03-0229	1.000
L18	CHOKE,COATED,0.47UH 10%,D=0.120IN L=0.300IN,I=650MA	08NR47	JEF	1810-03-0478	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION ><	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
L19	CHOKE,COATED,0.22UH 10%,D=0.120IN L=0.300,I=1025MA	09CR22K	JEF	1810-03-0228	1.000
Q01	JFET-N,TO-92,GP AMP AUDIO,V=25,Igss=-1nA P=310mW,NF=2.5,SS#1	2N5458	MOT	4901-05-4580	1.000
Q02	NPN,TO-98,AMP F=60M,V=25,Icbo=100n P=400mW,hFE=7K,*SS*	2N5306	G-E	4901-05-3060	1.000
Q03 Q04	NPN,TO-92,GP AMP/SW F=300,V-40,Icex=50nA P=625mW,hFE=100,*SS*	2N3904	NAT	4901-03-9049	2.000
R01 R02	(O)REC,C,1/4W,5%4.7K USE P/N:4701-03-4751	CF1/4-4.7K	KOA	4700-15-4701	2.000
R03 R04 R06 R07 R26	(O)RES,C,1/4W,5%,30K USE P/N:4701-03-3012	CF1/4-30K	KOA	4700-15-3002	5.000
R05	(O) SEE P/N 4610-00-1202	4610-00-4202	W-I	4610-00-4202	1.000
R08 R27	(O)RES,C,1/4W,5%,47K USE P/N:4701-03-4752	CF1/4-47K	KOA	4700-15-4702	2.000
R09	(O)RES,C,1/4W,5%,68K USE P/N:4701-03-6812	CF1/4-68K	KOA	4700-15-6802	1.000
R10 R11 R14	(O)RES,C,1/4W,5%6.8K USE P/N:4701-03-6811	CF1/4-6.8K	KOA	4700-15-6801	3.000
R12	(O)RES,C,1/4W,5%3.3K USE P/N:4701-03-3321	CF1/4-3.3K	KOA	4700-15-3301	1.000
R13 R22 R25	(O)RES,C,1/4W,5%,10K USE P/N:4701-03-1002	CF1/4-10K	KOA	4700-15-1002	3.000
R15	(P)RES,MF,30.1K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-30.1K-F-T/R	KOA	4701-03-3012	1.000
R16	(S)RES,MF,4.32K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-4.32K-F-T/R	KOA	4701-03-4321	1.000
R17 R18	(P)RES,MF,19.6K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-19.6K-F-T/R	KOA	4701-03-1962	2.000
R19	(P)RES,MF,2.10K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-2.10K-F-T/R	KOA	4701-03-2101	1.000
R20	(O)RES,C,1/4W,5%1.8K USE P/N:4701-03-1821	CF1/4-1.8K	KOA	4700-15-1801	1.000
R21	(O)RES,C,1/4W,5%,1K USE P/N:4701-03-1001	CF1/4-1K	KOA	4700-15-1001	1.000
R23	(O)RES,C,1/4W,5%,15K USE P/N:4701-03-1502	CF1/4-15K	KOA	4700-15-1502	1.000
R24	(O)RES,C,1/4W,5%2.7K USE P/N:4701-03-2741	CF1/4-2.7K	KOA	4700-15-2701	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R28	(O)RES,C,1/4W,5%160K USE P/N:4701-03-1583	CF1/4-160K	KOA	4700-15-1603	1.000
R29	(O)RES,C,1/4W,5%,20K USE P/N:4701-03-2002	CF1/4-20K	KOA	4700-15-2002	1.000
R31 R32	(O)RES,C,1/4W,5%,100 USE P/N:4701-03-1000	CF1/4-100	KOA	4700-15-1000	2.000

REFERENCE DESIGNATORS	PART DESCRIPTION ><	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
1	IC SKT,8 PIN	DILB-8P-108	BURND	2112-00-0007	2.000
C02 C08 C09 C10 C11	CAP,CER,470pF,300V 20%,FT, Z5P,LEADLESS .22"DX.25"L	2482-006-Z5P0-501K	TUSNX	1510-30-3501	5.000
C03 C04	CAP,CER,.01uF,100V 20%,RAD,Z5U,T/R .39"Dx.16"T,.25"LS	TGS10	SPR	1510-10-2103	2.000
C05 C06 C07	CAP,TNT,10uF,25V, 20%,AXL,D=3% .18"x.345"	173D106X0025W	SPR	1510-21-7100	3.000
C16	CAP,CER,.15uF,100V 20%,RAD,Y5V .20"H,.10"LS	CY20A154M	C-L	1510-11-1154	1.000
CR01	DIODE,GE PT CONTACT AXIAL,V=60,IO=50mA SUR I=500mA,*SS*,T/R	IN34A T/R	HIT	4807-01-0034	1.000
CR02 CR03	DIODE,RECT,GP DO-15,V=400V,IO=1.0A *SS*,TAPE&REEL	1N4004	P-C	4806-01-4004	2.000
CR04	DIODE,SIGNAL,GP AXIAL,V=75V,IO=10mA CT=4pF,*SS*	1N914	G-E	4807-01-0914	1.000
IC01	OP AMP,HIGH PERF PLAS,DIP-8,18Vdc .5V/uS,Vos=2mV,*SS*	N5741CV	SIG	7000-57-4100	1.000
IC02	TIMING CIRCUIT, PLAS,DIP-8,18Vdc HIGH STABILITY,*SS*	MC1455P1	MOT	7000-14-5500	1.000
J01 J02	CONN,SMA-F,50,PANEL	2056-0000	O-S	2110-02-1003	2.000
K01	RF RELAY 2PDT MR000-003	35BS5002K1	G-E	4510-00-0003	1.000
L01 L02	TOROID,10T,1-1/4L	LA009-010-1	W-I	1810-05-0004	2.000
Q01 Q02	NPN,TO-92,GP AMP/SW F=300,V-40,Icex=50nA P=625mW,hFE=100,*SS*	2N3904	NAT	4901-03-9040	2.000
Q03	PNP,TO-92,Amplifier F=100,V=25,Icbo=100n P=625mW,hFE=300,*SS*	MPS3702	MOT	4902-03-7020	1.000
R01	(S)RES,MF,51.1,1% 1/8W,AXL,TC=100ppmT/R	MF55D-51.1-F-T/R	KOA	4701-03-5119	1.000
R03 R09	(P)RES,MF,47.5K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-47.5K-F-T/R	KOA	4701-03-4752	2.000
R04*	(P)RES,MF,12.1K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-12.1K-F-T/R	KOA	4701-03-1212	1.000
R05	(S)RES,MF,357,1% 1/8W,AXL,TC=100ppmT/R	MF55D-357-F-T/R	KOA	4701-03-3570	1.000

REFERENCE DESIGNATORS	PART DESCRIPTION ><	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY
R06	(S)RES,MF,4.75K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-4.75K-F-T/R	KOA	4701-03-4751	1.000
R07	RES,C,1/4W,10%,4.7K	CB4721	A-B	4705-16-4701	1.000
R08 R13	RES,C,1/4W,10%,10K RC104-310AB	CB1031	A-B	4705-16-1002	2.000
R10	RES,C,1/4W,10%,22M	CB2261	A-B	4700-16-2205	1.000
R11	(P)RES,MF,100K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-100K-F-T/R	KOA	4701-03-1003	1.000
R12	RES,C,1/4W,10%,4.7M	CB4751	A-B	4700-16-4704	1.000
R14	(S)RES,MF,221,1% 1/8W,AXL,TC=100ppmT/R	MF55D-221-F-T/R	KOA	4701-03-2210	1.000
R15	(P)RES,MR,1.82K,1% 1/8W,AXL,TC=100 PPM T/R	MF55D-1.82K-F-T/R	KOA	4701-03-1821	1.000
R17	(P)RES,MF,1K,1% 1/8W,AXL,TC=100ppmT/R	MF55D-1K-F-T/R	KOA	4701-03-1001	1.000
S01	SWITCH,SM000-007	30-1	G-H	5111-00-0002	1.000